ol. XVI, No. 3 APRIL, 1946

THE TOOL ENGINEER

OFFICIAL PUBLICATION OF THE ASTE AMERICAN SOCIETY OF TOOL ENGINEERS

Editorial . . . . . *by C. V. Briner*

Mass Production of Porcelain Enamelware . . . . . *by Fred M. Burt*

The Tools and Techniques for the Production of Precision Gears—A Symposium—(Continued)

Gear Inspection . . . . . *by A. D. F. Moncrieff*

Power Formulas for Spur and Helical Gear Design . . . . . *by R. E. Meyer*

Elements of Electric Circuits . . . . . *by P. H. Winter*

Designing for Mechanical Press Forgings . . . . . *by John H. Parks*

Departments

Fundamentals of Tool Engineering • Tools of Today • Bulletins • Gadgets • North, East, West, South in Industry • Andygrams • Good Reading • A.S.T.E. News • Index to Advertisers

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AMERICAN SOCIETY OF TOOL ENGINEERS

Volume XVI **April, 1946** **Number 3**

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American Society of Tool Engineers

National Headquarters

1666 Penobscot Bldg. Detroit 26, Michigan

The TOOL ENGINEER
Editorial and Advertising Offices:
550 W. Lafayette Blvd. Detroit 26, Michigan

The Tool Engineer is published monthly at 1666 Penobscot Building, Detroit 26, Michigan, in the interest of the members of the American Society of Tool Engineers. Advertising and Editorial departments are located at 550 W. Lafayette Blvd., Detroit 26, Michigan. Subscription is $2.00 per year. Non-members $6.00 per year in the U.S.A., Canada, $6.50 per year; all other foreign countries, $8.00 per year. Copyright 1945 by the American Society of Tool Engineers. Entered as second-class matter February 8, 1945, at the post office at Detroit, Michigan, under the Act of March, 1879.

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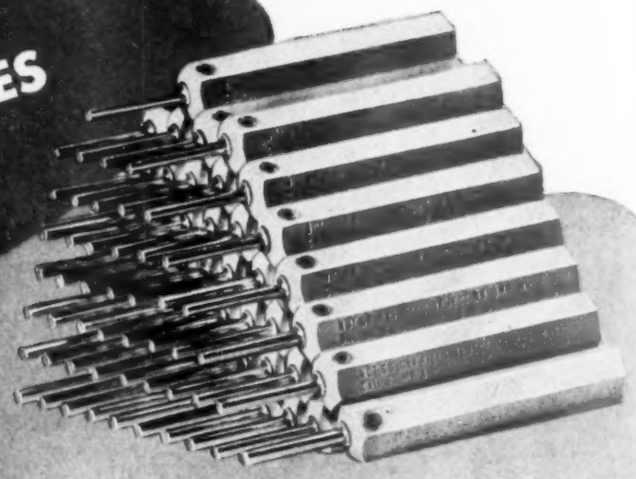

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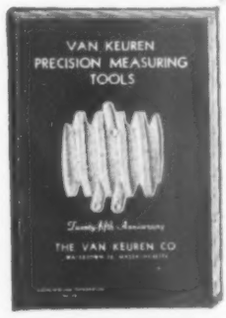

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What You Can Do with the DuBo* Gage

STANDARD

SINGLE END
Sizes 1.510" to 6.010"
(38 to 152 mm)

DOUBLE END
Sizes .240" to 1.510"
(6 to 38 mm)

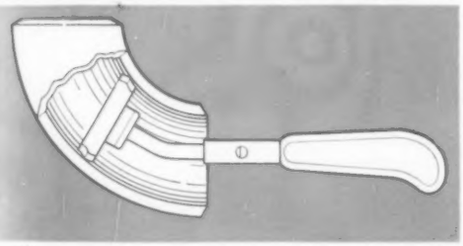
First

You can check plain, ordinary holes . . .

faster because the DuBo Gage is light, easy to enter (no pilot necessary).

better because you can check dimensional deviations such as taper and out-of-round.

GOES AROUND CORNERS

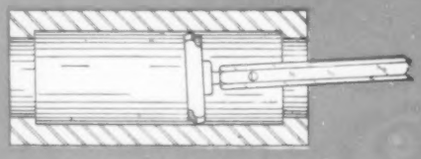


With the DuBo Gage you can even check around corners. Illustration shows a DuBo Gage with specially shaped shank for checking I.D. of an elbow at any point.

And

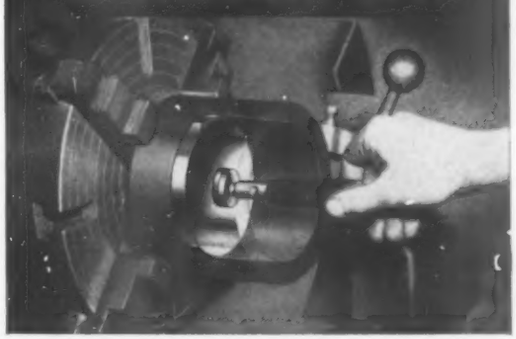
You can do other things with the DuBo Gage that you can't even begin to do with a cylindrical plug gage.

GETS BY CONSTRICTIONS



Diameter of entrance of this bore is, by design, .005" to .008" less than central section which is to be checked. DuBo Gage can be entered through constricted opening, and larger diameter can be checked with ease.

DETECTS BACK TAPER



Taper enlarging away from the opening can be detected with DuBo Gage without removing part from the machine.

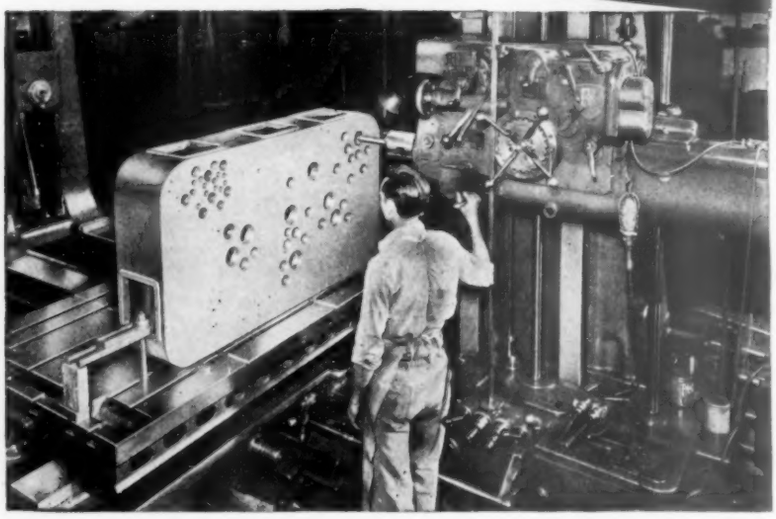
Write for Bulletin

*Patents Pending

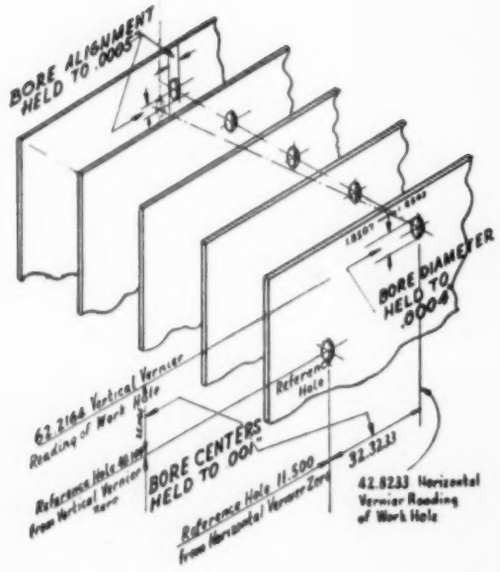
Send us your bore checking problem for engineering review and recommendation.

STANDARD GAGE CO., Inc., Poughkeepsie, N.Y.

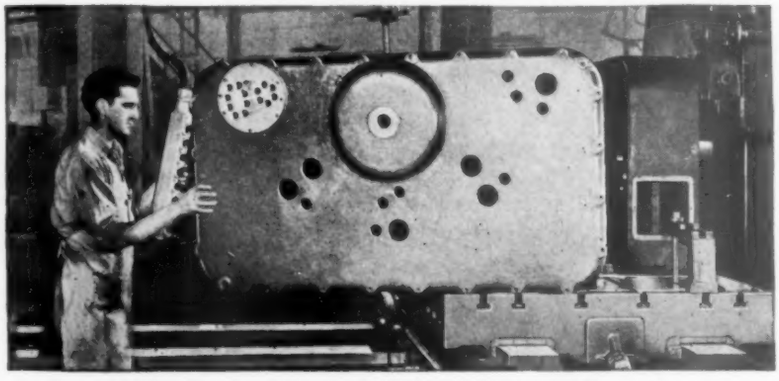
G. & L. HOLDS BORE



Holes are drilled, rough bored, counterbored and finished to precision limits in a single setting on this 28 spindle machine tool head.


BORE ALIGNMENT HELD TO .0005"
BORE DIAMETER HELD TO .0004"
62.2164 Vertical Vernier Reading of Work Hole
Reference Hole
BORE CENTERS HELD TO .001"
Reference Hole 11.500 from Horizontal Vernier Zero
32.3233
62.8233 Horizontal Vernier Reading of Work Hole

Sketch showing accuracy maintained in three ways. (1) Bore centers to .001"; (2) bore diameters to .0004"; (3) bore alignment to .0005".



Oil housing removed from machine head. At right on table—head in machining position showing center plate bolted in position.

G. & L. Table Type Machine — *G. & L. Floor Type Machine* — *G. & L. Planer Type Machine* — *G. & L. Multiple Head Type Machine*

GIDDINGS & LEWIS MACHINE TOOL CO.

Center Distances to .001"
Alignments to .0005"
Diameters to .0004"

Giddings & Lewis Horizontal Boring Machine Drills, Bores, Counterbores and Finishes 5 Assembled Plates with *Jig Borer Accuracy*...Machine Scales and Verniers Locate All Holes

Finish dimensions and limits equivalent to those obtained on jig boring equipment are achieved in a single setup on a Giddings & Lewis Horizontal Boring Machine. When this degree of accuracy is required, it is the usual practice to rough out holes on a different machine prior to final machining on a jig borer. This machine head shows how finish dimensions were obtained on a table type G. & L.

Standard machine scales and verniers locate all holes following simple arithmetical calculations. A reference hole is established in the workpiece and all measurements are made from that point. By simple addition, the operator quickly and easily arrives at the correct vernier reading for any line of holes.

TYPICAL VERNIER CALCULATIONS

Horizontal vernier reading at reference hole	11.500"	Vertical vernier reading at reference hole	40.100"
Drawing dimension indicating horizontal distance from reference hole to work hole	32.3233"	Drawing dimension indicating vertical distance from reference hole to work hole	25.1164"
Correct horizontal vernier reading at work hole	43.8233"	Correct vertical vernier reading at work hole	65.2164"

LESS MACHINING TIME REQUIRED

Overall production time is materially reduced on precision machining operations of this kind. Routing of the work over several machines for individual operations is not required. It is both possible and practical to complete all rough and finish cuts on the G. & L. Horizontal Boring Machine. Giddings & Lewis engineers are available to tell you how you can save time and simplify drilling and boring operations on your own work by utilizing the versatile features of Giddings & Lewis Horizontal Boring, Drilling and Milling Machines.

Free...

Helpful Production Facts and Data applicable to standard and special machining problems. Write today for actual field stories interestingly presented in G. & L. Production Data Folder TE-46.

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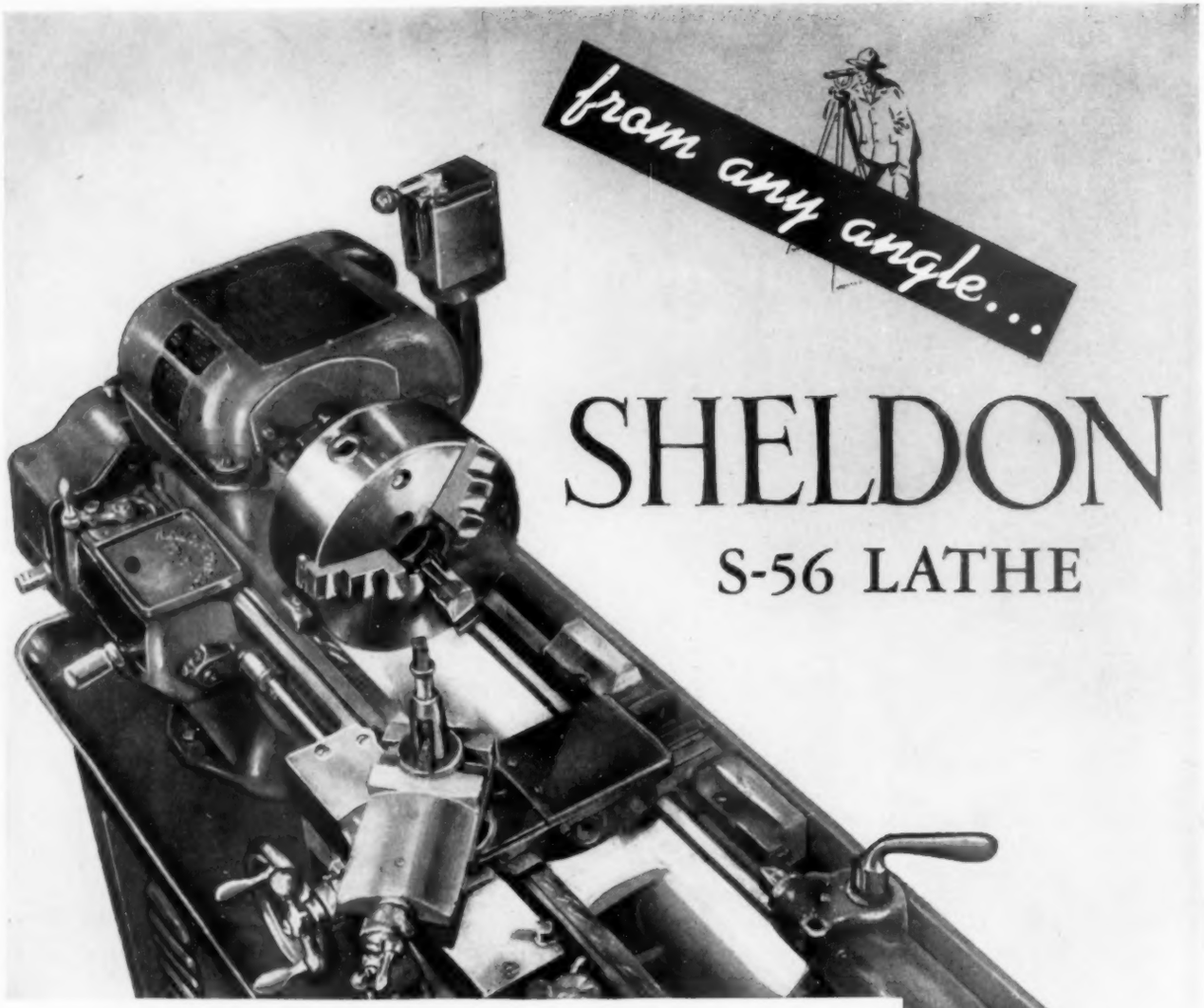

SHELDON

S-56 LATHE

- Heavy bronze bearings
- 1" Collet capacity
- 11¼-inch swing
- Double-walled apron
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- Extreme Accuracy
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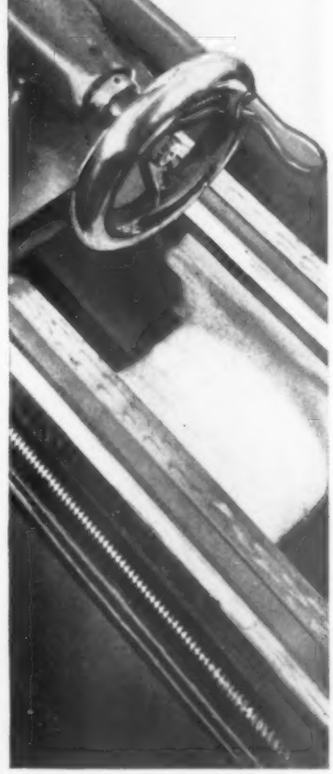

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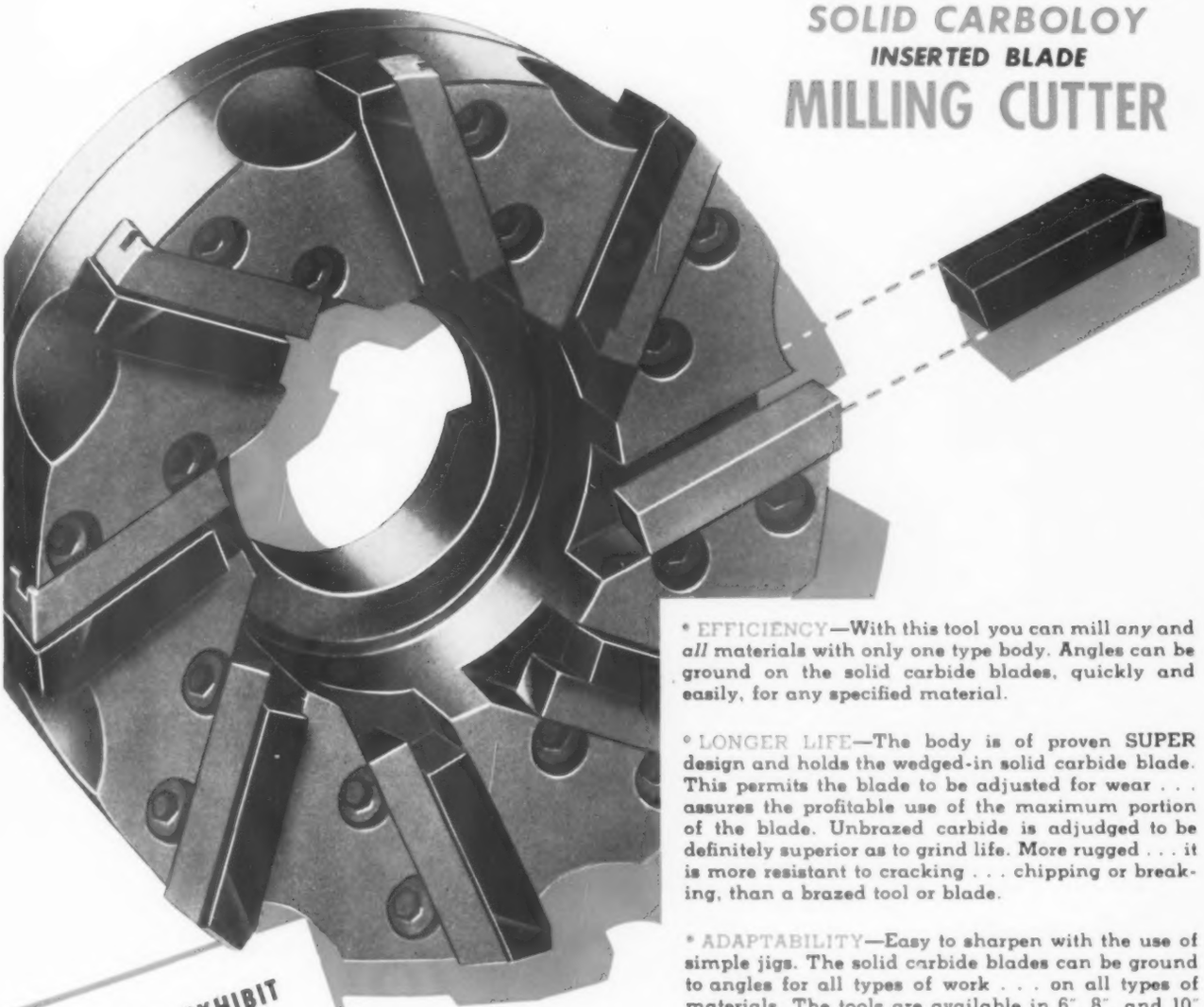

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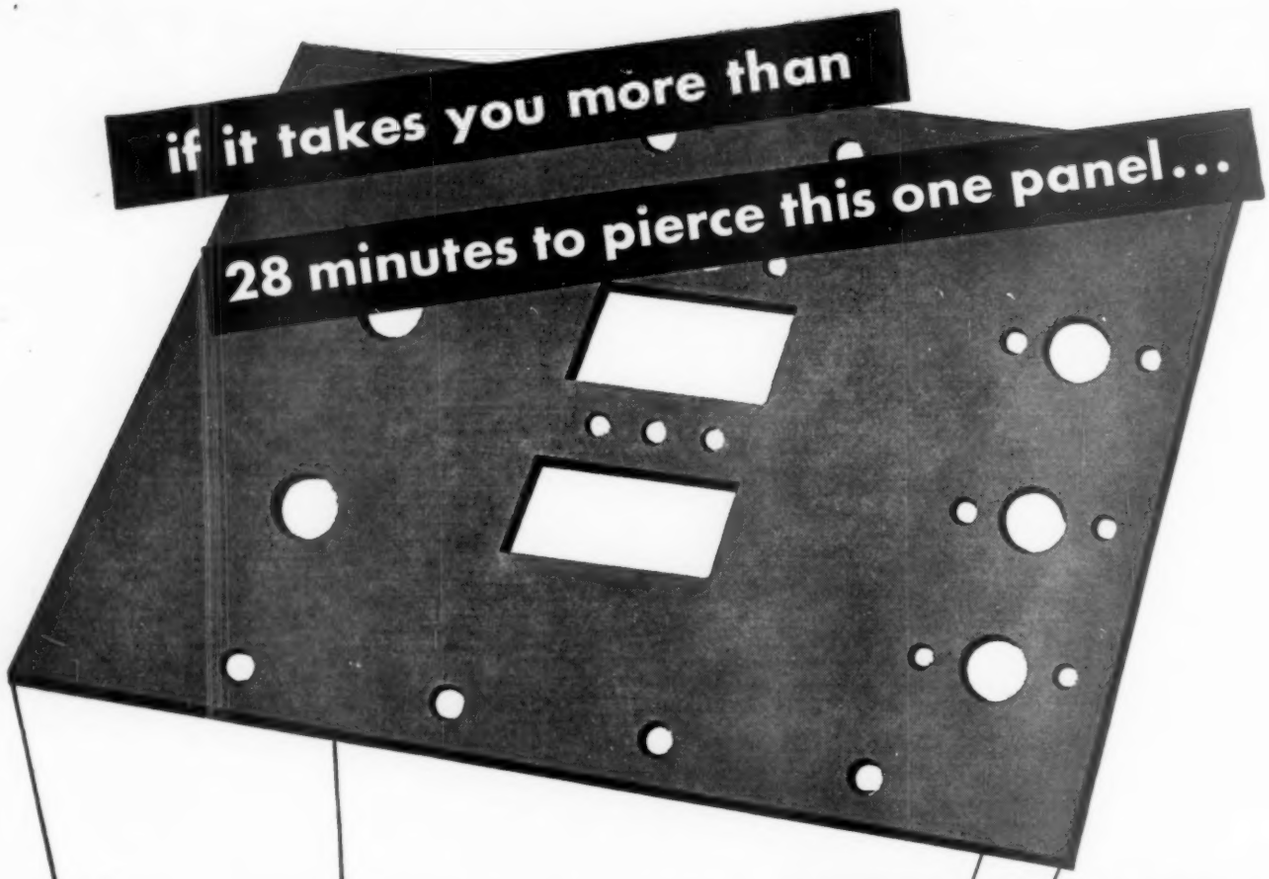

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PROBLEM: Specifications in contract for making U. S. Army cooking kettles called for a protective coating that came off easily with cold water. Absolutely no taste or odor could remain. The manufacturer preferred a coating to be applied by dipping at room temperature.

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CONCLUSION: It pays to consult the Shell Lubrication Engineer, regardless of the nature or size of your lubricating problem. Write for a copy of Shell's 40-page booklet on Rust Preventives. Shell Oil Company, Incorporated, 50 West 50th Street, New York 20, New York; or 100 Bush Street, San Francisco 6, California.

No one really cares what a Rust Preventive tastes like, but the maker of U. S. Army cooking kettles had to be sure that the Rust Preventive could be completely removed *so that it would not taste!*

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Equally sensational results are being obtained every day by the application of this revolutionary grinding method.

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The ASTE Spirit of Progress

SOMEONE once said "charity begins at home"—the same may be said for public relations and for the same reasons.

During the past thirteen months much has been accomplished within our Society which has increased our effectiveness internally and has increased our stature and standing from any given viewpoint.

The motive power behind this progress is best described as the ASTE Spirit of Progress. This spirit is derived from you and many more men like you—men who have ideals and willingness to work for these ideals.

Four major projects, any one of which would have been sufficient to undertake in any single year, were put into effect. These projects were as follows—The Tool Engineers' Handbook—Publishing our own magazine, THE TOOL ENGINEER—the National Directory—The New Era Exposition.

In addition, just for good measure, a revised constitution and by-laws was universally adopted by our membership and the National Headquarters office was reorganized.

By careful planning and foresight a good business-like set of rules have been established. The necessary organization to properly implement these rules has been set up. Worthwhile projects have been launched and are either progressing satisfactorily or have been successfully completed. We are on our way toward attaining our objectives. We have not yet reached our goal, but it is within sight and our courage has become stronger.

The responsibility for this planned progress was placed by the membership with the Board of Directors and the Elected Officers. These men have steered the prescribed course and with the able assistance of the National Committeemen and the Chapter Officers, have met their responsibility squarely and have served the Society well. The staff at National Headquarters have also become imbued with the ASTE Spirit of Progress and have performed beyond the course of normal duty.

In relinquishing the Presidency of the Society, I do so with the firm conviction that "our house is in order"—we are building good Public Relations from within, all of which will reflect itself in full measure for the good of the Society. I leave you the ASTE Spirit of Progress which will achieve its goal in placing the Society in its rightful place in the eyes of the world.

C. N. Brinser

A.S.T.E. President, 1945-46

By Fred M. Burt

Mass Production of Porcelain Enamelware

New Methods Bring an Old Art Within the Sphere of Mass Production.

Sheet Iron Products Porcelain Enameling

During the past 25 years, Porcelain Enameling has progressed from a secretive, haphazard art, with production of all but a limited number of items barred to the view of visitors, to one of the most progressive of industries. In methods, materials equipment, controls, research, literature and cooperative effort, the industry maintains superlative standards. Yet, the manufacturing techniques of this special glass, fused-to-iron and with "Lifetime Finish," are too little known. And while this article will cover the main points of production interest, there are infinite varieties of divergences, therefrom, to meet special conditions and requirements.

***Mr. Burt*, who has been previously introduced to our readers, takes us away from wonted tool engineering facts and into the less explored fields of mass production. In his article, he gives us an insight into the techniques of porcelain enamelling—an old art that has now responded to modern methods.**

As an art, porcelain enameling is almost as old as civilization. Porcelain enameled art objects, thousands of years old, have been found in China and other parts of the Orient and, due to the inorganic nature of the enamel, these are still in a perfect state of preservation. However, the first commercial use of the art, in the United States, started in the late 60's, and was based on knowledge—very crude knowledge—imported by immigrants from Germany and Austria. From then on, progress was very slow until in the 80's when the ugly old agateware (enameled steel kitchenwares) became common.

Between 1900 and 1910 numerous porcelain enameled signs were made, as well as a few stove and refrigerator parts. Also, the enameling of table tops started about that time, however, all such work was confined to about thirty utensil, sign and specialty plants. In the early 20's progress was still slow, with methods of manufacture closely guarded secrets.

Then, secrecy began to break down. Literature, on the art, made its appearance, the Enameling Division of the American Ceramic Society was formed, and improved enamel "frit," manufactured by several companies was made available, along with competent and complete enameling service—even to building and equipping an entire plant. From then on, there has been an accelerated progress. With that brief history, we'll come down to today and show the techniques of modern porcelain enameling.

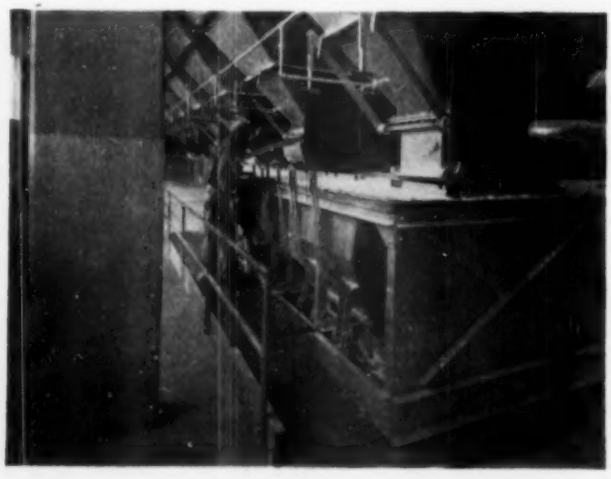
The enameling of the following, which includes most of the main items receiving this finish on a quantity, production basis, is done largely as herein described, with divergences indicated: kitchenware, hospitalware, signs, table tops, stoves, reflectors, refrigerators, washing machines, bathtubs, lavatories, sinks, building and architectural applications, commercial equipment and appliances, chemical and industrial applications, airmarkers for airports or routes and so on ad infinitum.

The great diversity of stampings, draws and special applications are patterned on designs particularly developed to meet the best requirements. Pure iron, ductile and subjected to special enameling and other treatments, is an essential, and the sheet iron used in connection with modern porcelain enameling has been carefully developed by major steel companies.

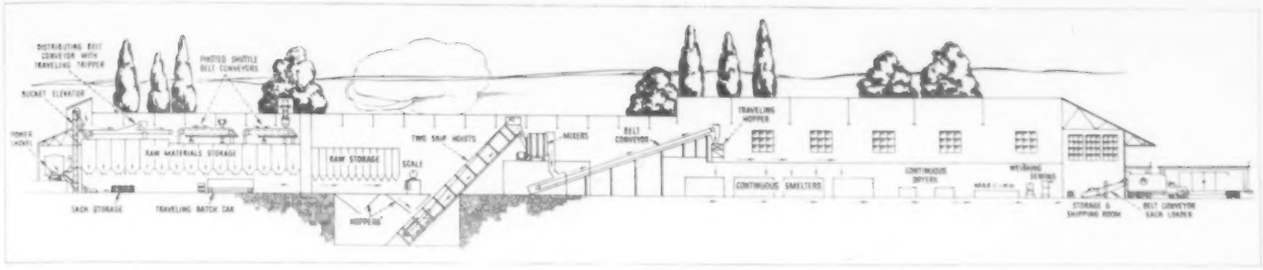
Preparation of Metal Surfaces

The metal surfaces to receive the enamel must all be thoroughly cleaned. Following are the practices and equipment in a highly modern unit, built for stove, heater and refrigerator parts. There are 11 tanks, each 13" long, 6' wide

Electrically operated batch-gathering car, used in the manufacture of porcelain enamel. Capacity of chemicals, 8,400 lbs. Openings are notched to fit mouths of feeders so wrong chemicals will not go in designated car.



Mixers, such as are used in mixing the raw chemicals used in the manufacture of porcelain enamel, prior to smelting.



Schematic "cross section" of porcelain enamel plant, showing flow of material from receiving to shipping.

and 7' deep. Eight tanks for ordinary cleaning and rinse solutions, two for acid, and the eleventh for drying. The solution tanks are of ordinary welded sheet steel construction.

Acid tanks are of the same construction, but lined with Koroseal and provided with an armor of vitrified brick set in Elaterite to protect the lining from the ware-carrying Monel baskets. Well lighted, the room has an air-conditioning system which changes the air in the room every 45 seconds, keeping it dust-free and eliminating fumes.

A mono-rail runs from end to end of the row of tanks which are set side by side. This carries a power-driven air hoist to handle the Monel baskets in and out of the tanks. (Electric hoists are also used extensively in cleaning and pickling rooms.) These baskets are carefully designed to facilitate loading and unloading while utilizing the full capacity of the tanks. Skimming is accomplished by side troughs at solution level, and the solution scum is moved to the trough by convection currents set up in the tanks by the heating coils in the bottom. Solutions are agitated by compressed air.

A manifold system, and a battery of electrically operated pumps, provides efficient solution handling. Solutions may be transferred at will between any of the eight cleaning tanks, or pumped directly into a 3-stage drainage sump. The sump designed is such as to facilitate the mixing of a neutralizing solution with acid after they are both ready for dumping into the sewer.

Each tank is heated by a pair of 1-inch submerged U-type burners operating on natural gas with a "stand-by" oil burner. An "electric eye" scans the burner and pilot light in each burner installation. If the burners go off the electronic cell responds immediately by setting in motion an apparatus to turn off the gas, at the same time sounding a warning signal.

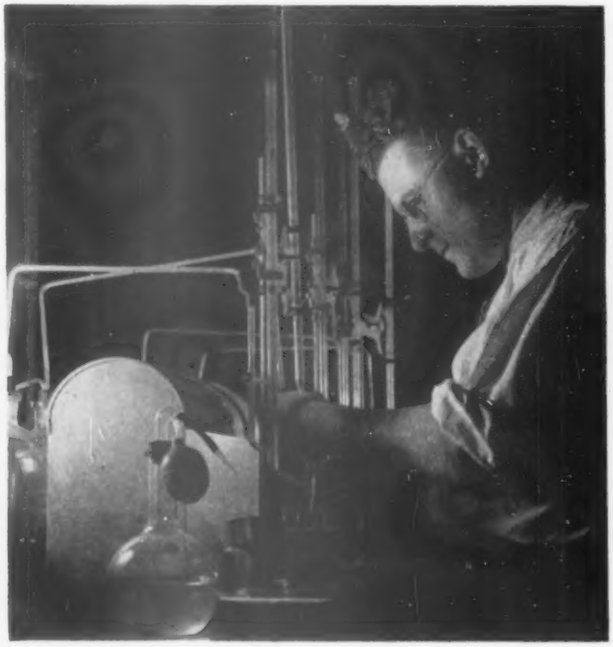
An induction coil and ordinary spark plug are used for lighting the pilot light in each burner. The coil transformer operates directly from a 110-volt supply and furnishes 9000 volts to the spark plug terminal. This installation works very well and eliminates hand-lighting.

Each tank is equipped with a standard mercoid bulb, temperature control apparatus capable of maintaining solution temperatures within plus-or-minus 5 degrees. A commodious, well-lighted subterranean passageway, accessible through a trap door in the cleaning room floor, extends the entire length of the tank pits and houses the burners, burner controls, temperature controls, and manifold piping system. A room adjacent to the passageway contains the solution pumps, a 1,000 gal. raw acid tank, and an oil pumping plant. All piping in the manifold system is painted to conform to a color code to designate what is carried. Acid is carried in Monel pipes.

In standard cleaning and pickling practice, the ware first goes into a boiling alkaline cleaning solution for removal of

Inspecting the "frit" after drying. This "frit" is later ground, in the plants of user manufacturers with water and inorganic coloring materials added to form liquid porcelain enamel. Liquid porcelain enamel is subsequently sprayed on the part and fired in a furnace heated to approximately 1,500 degrees F.

Laboratory control plays an important part in the manufacture and application of porcelain enamel. View here shows titration of raw material.



any grease or oil. (Drawn or pressed products use vegetable oil soaps in the forming operation because it is water soluble and supplements the action of the alkaline cleaner.) The cleaning process uses up a certain amount of the alkaline chemicals. Consequently the strength of the solutions must be titrated, or otherwise tested for strength at regular intervals, so that the solution may be kept at the strength that experience has shown to give the best continuous results. The time that the ware is left in the cleaning tank is generally from 10 to 20 minutes. A longer stay is not harmful.

Pickling is done in sulphuric acid solution of about 6 per cent actual acid concentration strength held at about 160 degrees F. temperature. Both strength and temperatures are constantly maintained. The time is again about 10 to 20 minutes, although rusty, scaly ware may take longer. The acid attacks and removes the rust and scale and then attacks the ware metal itself. A slight roughening of the metal surface is deemed, by some, to be of advantage in promoting enamel adherence, but it is very important that this be closely controlled.

After using the pickling solution for a few days, it should be tested daily by chemical titration with permanganate solution, or with iron test pills, to ascertain iron sulphate content. When it reaches 6 per cent the acid should be changed. A thorough draining and a warm or hot water rinse follows, then, submergence in the neutralizing solution of 0.80 oz. per gallon of water (at about 160 degrees). The solution is 90% soda ash and 10% borax. Next, another draining and thorough drying, and the ware is ready for dipping or spraying.

Enamel, Its Manufacture and Preparation

What porcelain enamels are made from is illustrated by the following representatives formulas.*

Porcelain Enamel Formulas

Chemical	B-37	B-80	B-6	B-AR-106	BHH Glaze
Feldspar	20.40	25.67	19.00	——	32.00
Silica	24.40	22.33	21.60	38.53	22.00
Fluorspar	4.90	5.33	5.30	3.67	——
Borax	37.42	27.67	27.00	20.20	25.00
Soda Ash	6.60	7.33	4.00	5.50	6.00
Nitrate of Soda	3.68	4.33	3.00	7.34	5.00
Cobalt Oxide	.75	6.00	——	——	——
Maganese Dioxide	1.60	1.00	——	——	——
Cryolite	——	4.33	11.30	——	10.00
Zinc Oxide	——	——	4.80	2.75	——
Antimony Oxide	——	——	4.00	——	——
Sodium Silico-Fluoride	——	——	——	5.50	——
Nostane No. 4	——	——	——	16.51	——
Black Oxide Iron	——	.50	——	——	——
	100.25	100.14	100.00	100.00	100.00

Mill additions per 100 lbs of frit, in addition to indicated quantities of water.

	Lbs.	Lbs.	Lbs.	Lbs.†
English (or other) Ball Clay	4-7	4-6	5-8	4
Vallendar (or similar) Clay			5-8	4
Soda Ash	½			
Tin Oxide			6-8	5
Magnesium Carbonate			½	½
Epsom Salts			2 oz.	

Most of the colors, particularly the pastels, are obtained by additions of proper oxide coloring pigments to cover coat enamels. Exact shades are predetermined by milling small quantities in laboratory mills.

†This is variable as it is base for many colors made by different mill additions of coloring oxides, especially good for reds.

*These formulas were set up by Mr. Burt and were used during the 30's—or until the start of the war.

While the many plants producing their own enamels accomplish the same results by various methods, the production of the enamel—called "frit" after the smelting process is completed—is generally as conducted in the main (Cleveland) plant of the Ferro Enamel Corporation—probably the world's largest producer, with plants in the United States and several foreign countries.

All raw chemicals are laboratory checked to be certain that they are all up to specified chemical analyses. Carload lots are taken from the freight car with a power shovel and picked up by a bucket elevator to be carried to an upper level. This decants the chemical into a distributing belt conveyor, with a traveling tipper, for deposit in the proper raw materials storage bin.

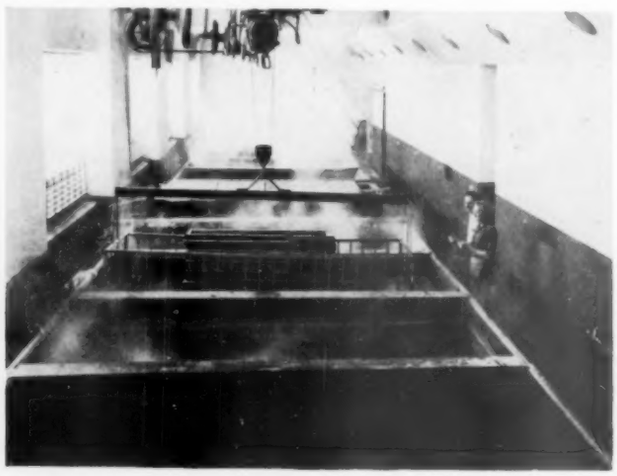
Smelting

In picking up the batches, according to formula for mixing, a traveling batch car and automatic weighing scales are used. The weighed chemicals drop into hoppers and then move via skip hoists to the mixers. After very thorough mixing, the mixed batch drops on an ascending belt conveyor to be carried to traveling hoppers on a level above the specially designed, continuous smelters. Each of these has a capacity of about 1500 lbs. per hour, 24 hours a day. Special formulas are handled separately in batch-type smelters. Ground coat and white enamels are smelted in different smelters. All smelting is done under very close time-temperature control.

Temperatures ranging above 2000 degrees F. reduce the enamel ingredients to molten glass. This glass pours forth in an incandescent stream into a cold water quench that shatters it into tiny fragments of uniform frit. Out of the quenching baths, the frit is conducted through batteries of

Pickling in acid baths to clean the ware thoroughly before a porcelain enamel coating is applied. Coating is done by spraying or dipping.

View of eleven tanks with hoists, in cleaning and pickling room at O'Keefe & Merritt Co.



dryers and over powerful magnetic separators to remove all traces of harmful foreign particles. The enamels are then placed in special sacking, marked and weighed, sewed and thence into storage.

Milling

Enamels are applied in liquid form and are milled into this condition (enamel slip), in cylindrical ball mills. Ground coat, white, and color enamels are milled or ground in separate mills. Mills are lined with high quality, white porcelain blocks. The grinding media are dense, white, low porosity porcelain balls. This whole operation of enamel preparation is scientifically controlled throughout.

Balls are kept at uniform size by regular decanting and sorting, and the size (also, the rpm of the mill) is determined by the inside diameter of the mill. A one-foot diameter mill should run at 40 rpm and so on up to 17 rpm for a 7 ft. 6 in. diameter mill. The mill should be one-half full of balls and then charged up to the three-quarter mark with frit and other mill additions.

The other mill additions, according to formula, are clay which serves as (a) flotation agent necessary to hold the small particles of milled enamel in suspension in the water, (b) as a binder, after application to the ware and drying, and (c) affects the fusing temperature of the enamel, usually increasing with added clay. (d) Dissolved in the enamel in the firing process, clay affects the physical properties and co-efficient of expansion of the enamel, and (e) affects the opacity, color and brilliance of the fired enamel. Opacifier is added if it is a white enamel or white base with colors added, in some instances tin oxide is the most widely used opacifier. Others have zirconium and antimony bases. Opacity of porcelain enamel is caused by the combined reflection, refraction, and diffraction of light which is incident upon the enameled surface.

All Colors and Pastel Shades Attainable

Every color and shade can be obtained by adding coloring pigments to transparent, opaque white and colored frit. Some colors are obtained in the smelting—for example, cobalt blue, or black. These pigments are principally metallic oxides. Electrolytes ("setup" salts) such as borax, are often added to aid in the suspension. Complete analysis of this set-up, in the mill and subsequently, is a long story. There are other special additions for specific requirements, and water is always added to formula in the area of 35-40% of the weight of the enamel.

The milling is rigidly controlled and all enamels are brought to the exact fineness and specific gravity required for the type of enamel and method of application. After milling is carried on for the time calculated to give this fineness, an exact check is made by determining the gram residue left after a 50 c.c. sample is washed through a 200 mesh sieve.

Enamel is generally discharged by gravity flow from the mill, and is carefully sieved, preferably through a rotary spray sifter, and should then be passed over a magnetic separator. It should be aged from 24 to 48 hours before using. Enamel storage is generally in large, steel, cylindrical tanks equipped with agitators.

Enamel Application by Dipping, Draining and Spraying

Blue or blue-black ground coat is necessary for the first application, as although it has been intensively sought, no formula has ever been perfected that would produce a satisfactory, light-colored ground coat. Such chemicals as cobalt oxide, manganese dioxide and black nickel oxide have always, though used in small quantities, been found necessary to make an enamel with the fused-in adherence that makes it virtually integral with the metal at the interface. Subsequent coats, of proper enamels, fuse integrally with the ground coat and with each other.

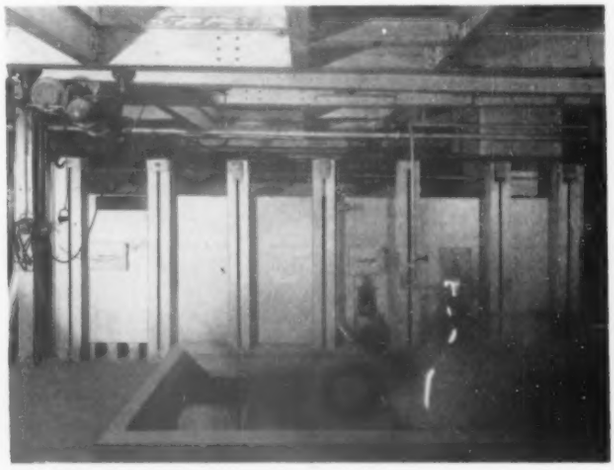
Ground coat is seldom sprayed; however, spraying is good practice on a continuous, automatic spray line on some large area, flat items. All kitchenware, hospitalware, reflectors and some other items are hand-dipped by expert "dippers" (a vocation principally staffed with feminine personnel for over 40 years) for all coats. The enamel is placed in porcelain enamel coated dipping tanks, and "set up" most often with a borax solution to give it the right dipping consistency.

Dipping Requires Dexterity and Experience

The dipper has the ware delivered at a convenient side-table and takes each piece to be dipped, generally using a tong especially designed for each type of ware, and immerses it in the enamel. Then, with dexterous movements, distributes the enamel evenly all over the ware, shaking off any surplus. The dipped item is either placed on sharp, steel pegs set in long, narrow, soft-wood boards, for movement to placement on parallel, horizontal chains moving through a dryer, or it is hung from hooks on a conveyor chain moving through this dryer at a higher level.

Porcelain enamel coated parts are "fired" in either a "box" (or batch) or continuous type furnace. Box type furnace shown.

Smelting is the heart of the porcelain enamel manufacturing process. The raw chemicals are subjected to heat of around 3,000 degrees F., to fuse the components into a material having the properties of glass. The smelted material comes out of the smelter after 5-8 hours (here shown) and is discharged into a tank of cold water which shatters it into millions of tiny fragments, called "frit."



There are many variations from this practice. The ware may be placed on special carriers to move directly into a continuous furnace through a drying chamber. But if not, at the exit end of the dryer, the dried-ware boards are removed and the ware is transferred to boards of the same size, covered on one side with Canton flannel, a soft contact surface that will not rub the enamel from the ware. Inspections take place between the dipper and dryer and again after drying. The dried ware is then placed on large, rubber-tired racks for storage and subsequent movement to the furnaces.

Dipping and Draining

Many items, such as stove and refrigerator parts, signs, table tops, and many specialties, are dipped by one or two operators and set up at proper angles to drain to a smooth coverage, often on a traveling line which carries them on into a dryer, or dryer-continuous furnace. This makes is especially necessary to have the enamel in the right condition of "flowability."

Units dipped in cover coats (and two cover coats is standard practice on most items) are dipped, inspected (if improperly dipped, handed back to the dipper for a re-work while still wet) and hung on a conveyor line to run through a continuous furnace, or through a dryer and on to the flannel-covered boards when they are to be burned (fused) in box-type furnaces.

Kitchenwares, reflectors and any other item receiving a trimming "beading" operation, are dried and placed on the flannel-covered boards and racks, and moved to "beaders" who take them board-by-board from the rack, and then piece-by-piece from the board, to apply the bead dexterously by the fingers of one hand, while holding the ware in the other. Then, it is replaced on the board, the board on the rack, and thence to the furnace, or directly on a continuous furnace chain.

Spraying

Outside of the wares that require hand-dipping, practically all other enamel application in cover coats is by spraying, and continuous furnaces are used extensively. Automatic spray set-ups can be used on flat pieces. Other items are hand-sprayed as they pass through the spray booth suspended from the dryer or furnace, overhead, conveyor chain. Much research is being conducted, with promising results, in the technique of electrostatic spraying of porcelain enamels.

In other instances, the ware is sprayed in standard spray booths, and then hung on the conveyor chain. Careful inspections at many strategic points provides for catching any imperfectly coated units, that they may be removed, the unburned enamel washed off (for subsequent reclamation) and the unit returned for re-coating. When the ground coat is necessarily washed off, the item must go through the pickling process again.

Brushing

Brushing is the process of removing part of the dried coat of enamel by cutting, rubbing or brushing, and exposing the iron or previous enamel coat. The equipment and methods are too varied to be covered in detail, but sufficient to say that special brushes (hand and powered) and other tools, with holding fixtures, stencils, strips and other equipments allow efficient removal of enamels.

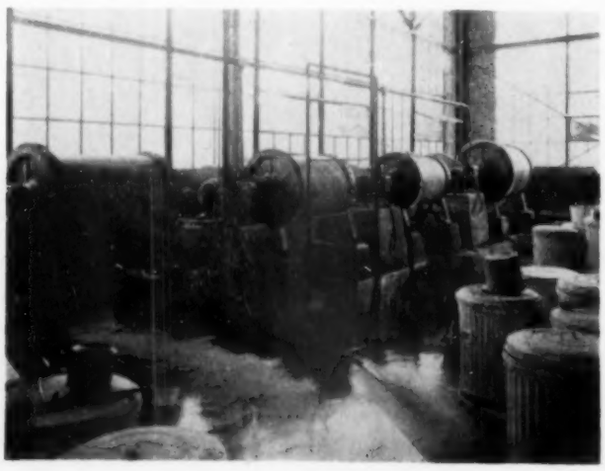
Stencils are used extensively in sign manufacture where a sign may require several colors, designs and enamel coatings. Special decalcomania transfers, and the silk-screen process of applying enamels, are also used extensively in sign manufacture. The black edges, that may be noticed on stove parts, are obtained by over-spraying the dried ground coat on these edges, with a black enamel, and then burning it at the same time as the ground coat. Each cover coat is brushed off according to the design desired. Brushing tables of various sizes have grid tops with strong, down-draft exhausts to carry the dust away.

Burning

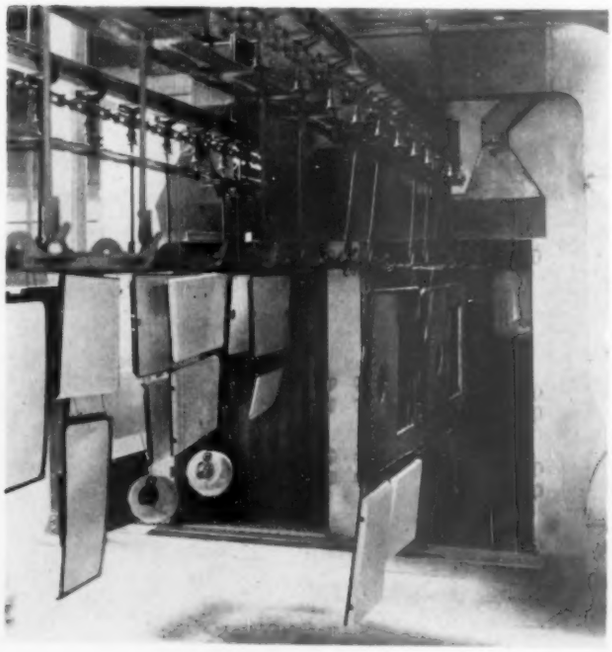
Burning of each of the coats of enamel, is done in either a continuous or box-type furnace. Oil, gas and coal fired

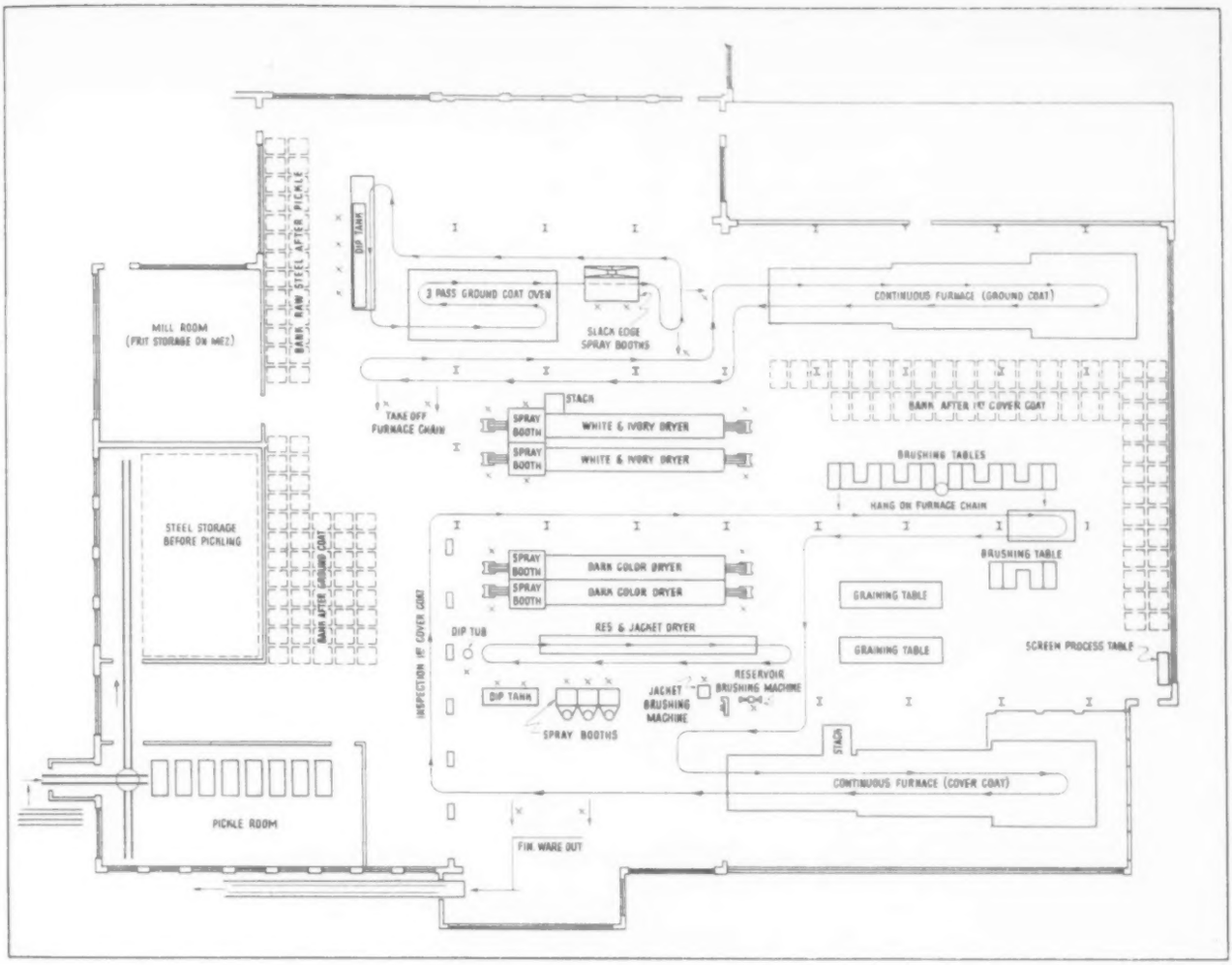
Photomicrograph of the union of porcelain enamel ground coat fused to enameling iron (Armco iron).—*Photo by courtesy of American Rolling Mill Co.*

Milling of the porcelain enamel. Frit, inorganic colors, water and suitable electrolytes are ball-milled to form a liquid solution.



A continuous type porcelain enameling furnace.



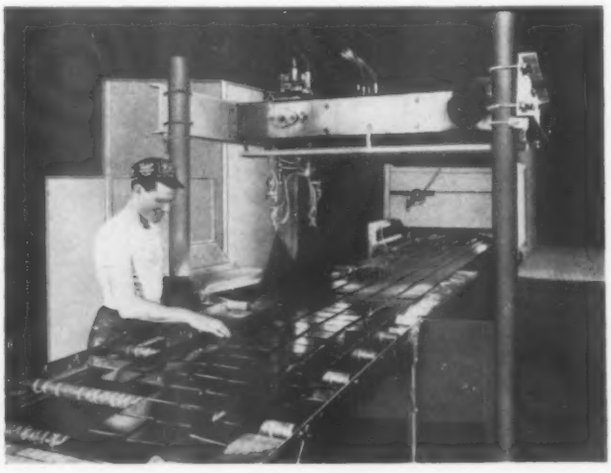


furnaces have full muffles. With electric heat, the application is direct. Continuous furnaces are of the U-type or straight through. Ware is carried on hooks of special, heat resistant, nickel-chrome alloys, suspended from the carrying chain above, and projecting downwards through a narrow slot in the furnace roof.

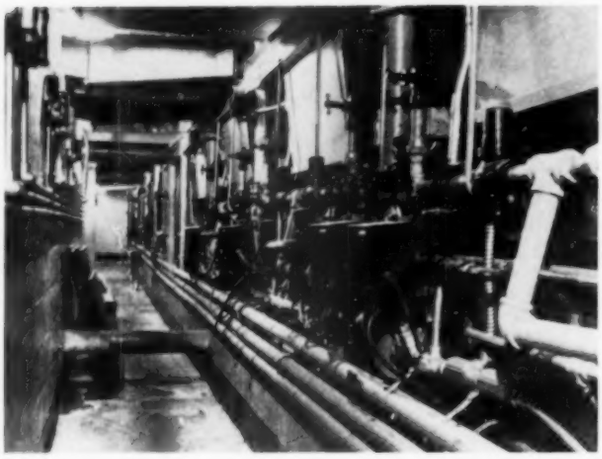
The ware is carried on varieties of auxiliary carrying fixtures, also of the special alloy. It first enters a pre-heat chamber, heated by the heat radiated from wares in the adjacent, counter-flow cooling chamber. Next, into the hot zone for fusing, at from about 1530 degrees to 1650 degrees F. The time temperature element is very closely controlled, and set to suit the specific wares being burned. Thus, there must be careful selectivity in the sizes and gages of wares traveling together. Cover coats are burned at temperatures a little lower than ground coats.

In box-type furnace burning, wares may be placed on "burning irons." These carry sharply pointed pins of the

A DeVilbiss automatic transverse spray machine, with a down draft exhaust system, sprays porcelain enamel on wall tile at a high rate of speed.



Spraying, following which ware is hung on a chain to be conveyed into the continuous type porcelain enameling furnace.



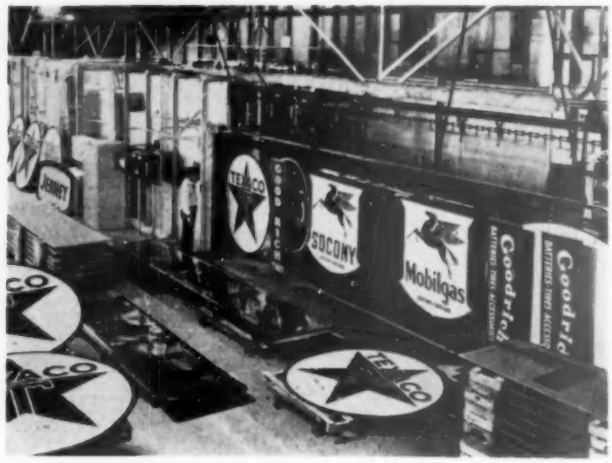
General view of subterranean control room, showing the manifolding system, the temperature control devices, and the provision made for both natural gas and fuel oil firing. All valves and equipment are in accessible locations for ease of inspection and maintenance.

alloy steels and are laid crossways of the charging fork and the longitudinal ware "pigs" inside the furnace. The latter are made of refractory material and rest on the furnace or muffle bottom, with two on each side and one in the center, and are spaced so that the fork enters the furnace just inside the outer two pigs. Double-decker racks are used, also, special racks that project high in the furnace and allow most of the cubic content of the furnace to be used by hanging wares from different levels.

Double forks are used to speed up the furnace operation. With two sets of ware-carrying fixtures, while the other is in the furnace with its load, the two (or three) operators are unloading and loading one. While this is going on this fork is at one side. When the burned load is removed, the door opens—generally by air or electric hoist—the fork is run in, manually or automatically, at the lower level just above the furnace bottom.

With all of the support from without the furnace (requiring a sturdy fork) it is then raised with strong leverage to lift the load clear of the furnace supports, and then retracted. The door is then closed. Next, the double fork moves sideways to place the unburned load in charging position, the door opens, it goes in, the fork drops the load, comes back out, the door closes, the double fork moves the burned load to the side for unloading, and the cycle is completed.

A hearth (furnace bottom) size 5' x 12' and with heights up to 6' to the top of the muffle arch, is most widely used.



Porcelain enameled Armco Iron signs entering continuous furnace.—*Photo by courtesy of Ingram-Richardson Mfg. Co., Beaver Falls, Penna.*

Fuel fired furnaces generally have silicon carbide or fused alumina, refractory muffles, as these refractories have the best heat conduction properties and can stand the gaff of high heats. Box-type furnaces also operate under the closest of automatic pyrometric control. Much burning is done by timing, but a trained "burner" can tell exactly when the load is ready for removal by looking at it through his peephole, judging by looking at different spots and the incandescence and gloss that develops. Ware for these furnaces is delivered on various types of racks, placed in convenient locations by "rack-pusher." Burned wares are placed in metal lined trucks.

After the burning of each coat, and particularly after the finish coat, every piece is carefully inspected. Defects are remedied in a great variety of ways, or wares are downgraded or junked. Much more could be written about every process herein outlined, about inspections, correction of shop troubles, and process control methods. But, a sufficient to say, that, in the *Techniques of Porcelain Enameling*, an answer to every single problem has been worked out in methods of thoroughness, efficiency, modernity. A top "enameler" is a real technician.

As a concluding note, it is suggested that postwar enameled products will be largely coated with superior acid-resistant enamels that will retain the original gloss and smoothness through anything but severe misuse, and will be highly resistant to chipping.

A sequel to this article, on Porcelain Enameling, will follow in May The Tool Engineer.

Unusual Performance of Carbide Tipped Tools

The Firthite-tipped tool, shown below, took a $2\frac{3}{4}$" wide cut at high speed, and a feed of .011-inch per revolution, while boring cast armor on tank parts. This unusual performance of carbide tools on turning, facing and boring operations increased the productive capacity of the boring mill. It had been planned originally to use 650 machines, but with the new tools 400 boring machines accomplished the work.

All this, of course, took unusually rugged tools, which had to be securely clamped, in the tool holders, to withstand the severe shocks and strains incidental to interrupted cuts. How well they performed, however, can be judged by the chips immediately under the tool. These special tools were fabricated by Firth-Sterling Steel Co., McKeesport, Pa.

By Phil Glanzer

Infra-Red Ovens Speed Drying

From Hours to Minutes With Modern Techniques in Paint Drying.

A modern installation of infra-red drying lamps at the Walkerville (Ontario) Engine Plant of General Motors of Canada has solved a problem of handling of motors after painting. From a previous time of several hours, the time for drying the finish hard enough to handle has been reduced to about four minutes.

Under the old system, the finish was invariably marred in removing engines from their slings prior to being placed in wood cradles for storage or shipment. This made it necessary to have a workman present, with brush and paint, to touch up spots on the motor from which the paint had been scuffed. Also, after spraying, paint dripped from the motors and solidifying on the floor under the conveyor, made plant housekeeping difficult.

Phil Glanzer **is a graduate of Ohio State U and of O'Sullivan College of Business Administration, Montreal. He is a life associate member of the British Institute of Eng'g Technology (affiliated with the Canadian Inst. of Science of Technology).**

An infra-red drying oven was placed in the production line and the troubles vanished without cutting down production time or taking much more valuable space than formerly required for the conveyor line itself.

Overhead Conveyor

The motors, passing through a modern water curtain spray booth, are carried on an overhead chain conveyor by specially designed hangers directly into the intra-red oven. The conveyor moves at a speed of five feet per minute and motors are hung on six foot centres. The infra-red oven is 20 feet in length and is composed of fifty infra-red oven sections, each containing twenty 250 watt drying lamps. Thus, there may be four motors moving through the oven at one time and each motor is subjected to the drying rays for a period of only four minutes, yet, on emerging from the drying "tunnel" the paint is quite dry enough to permit handling without damage to the surface.

As described by an industrial heating engineer, the oven is constructed of box-like sections, each a unit in itself, and containing special heat lamps with highly efficient reflecting surfaces on the inside of the glass. These lamps are held in special heat resisting sockets and are almost entirely enclosed by the box frame of the section, only the "business end" of the lamp protruding from a bright metal reflector sheet which is designed to catch stray infra-red rays and redirect them towards the surfaces to be dried.

The sections are mounted on a light angle iron framework and form a tunnel about eight feet wide, five feet high and twenty feet long. The oven is made up of three banks of lights, each containing 200 lamps, 100 on each side of the work. These banks are each six feet long and are mounted at 12 inch centers.

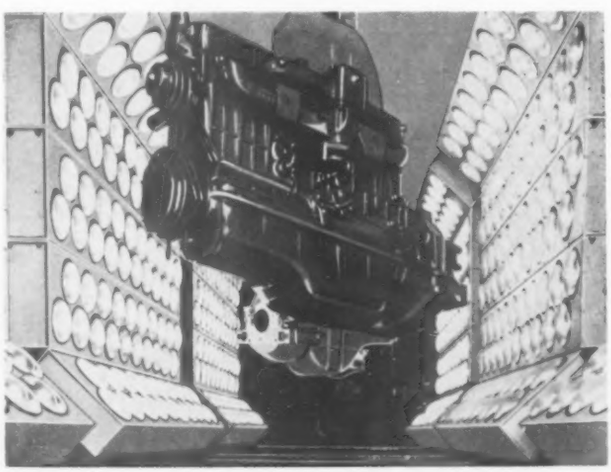
At the entrance to the oven, there is a sheet metal shield designed to prevent unwanted drafts of cool air from going through the oven and slowing the drying operation. Should it become necessary to dry work of entirely different size and shape, the whole unit may be disassembled, and due to the sectional construction, quickly remade in any one of a number of shapes or sizes, at very low cost.

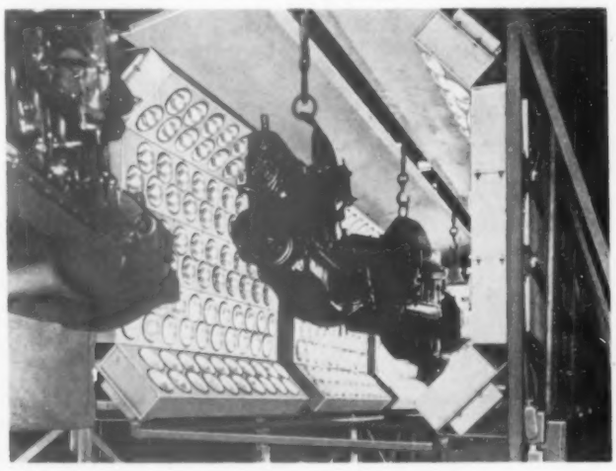
Heat Is 200 Degrees

Each individual 20 lamp section is wired for 550 volt operation, cutting down wiring and power costs and making electrical control very simple. Each separate 5 section bank of lamps is controlled by its own manually operated magnetic switch. This arrangement provides maximum flexibility in the oven at lowest cost.

On their way through the oven, the painted surfaces of the engines attain a temperature of over 200 degrees, quickly driving off the volatiles from the paint and leaving a firm, glossy surface. These engines are massive, each weighing nearly 600 pounds. Hence, the great saving that results from using radiant energy for drying may be readily seen since it is not necessary to raise the entire mass to drying temperature, as in the conventional convection oven, but only to raise the temperature of the surface on which the actual drying is done. The installation also provides more comfortable working conditions around the conveyor line, since each motor has less residual heat after leaving the oven and hence gives up less heat to the surrounding area.

Six hundred 250 watt infra-red lamps, in this 150 kw General Electric drying oven, dry paint on automobile engines in 4 minutes.





A Symposium

The Tools and Techniques for the Production of Precision Gears

Installment No. 4, in which Power Formulas and Gear Inspection are Added to the Store of "Know-How" of Modern Gear Manufacture.

Power Formulas for Spur and Helical Gear Design

By R. E. Meyers

This article, by Mr. Meyers, is an especially valuable contribution to the science of gearing. Due, however, to the complexity of make-up, it was necessary to set the article in monotype, thereby varying from the established style of The Tool Engineer.—*Ed.*

R. E. Meyers **studied engineering at San Francisco Polytechnic and Lick-Wilmerding Jr. College. Employed as mechanical engineer at the San Francisco Naval Shipyard, on tool and machine design, he taught machine design at Stanford University during the war.**

TABLE 1—GEAR MATERIALS

Material	Heat Treatment	Brinell Case	Brinell Core	Yield Point	Sb	Sw
SAE 1020	As Rolled	143	143	43,000	14,500	1,500
CASE HARDENING STEELS						
SAE 1020	Water Quenched Drawn to 350° F.	690	192	60,000	20,000	13,000
SAE 4620	Double Quenched in Oil Drawn to 300° F.	645	255	84,700	28,000	12,000
NE 9420	Same as 4620	645	269	67,500	23,000	12,000
NE 9420	Oil Quenched Drawn to 450° F.	614	429	200,000	67,000	10,500
FULL HARDENING STEELS						
SAE 1040	Water Quenched Drawn to 600° F.		444	95,000	31,000	5,000
SAE 3140	Oil Quenched Drawn to 500° F.		514	233,000	78,000	8,000
SAE 4340	Oil Quenched Drawn to 400° F.		534	225,000	75,000	9,000
NE 9440	Oil Quenched Drawn to 400° F.		578	249,000	80,000	10,000
STEELS FOR GEARS CUT AFTER HEAT TREATMENT						
SAE 1040	Oil Quenched Drawn to 400° F.		262	86,000	29,000	3,200
SAE 3140	Oil Quenched Drawn to 800° F.		388	178,000	60,000	4,300
MISCELLANEOUS MATERIALS						
Gray Cast Iron			180		6,000	1,200
Alloy Cast Iron			220		10,000	1,800
Cast Steel			125		18,000	1,400
Phosphor Bronze			90		10,000	1,000

This article presents formulas for the direct solution of spur and helical gear power problems. Although the mathematics involved is no simpler than that used in existing methods, the amount of work is greatly simplified. The number of formulas are reduced and the solution is obtained directly in lieu of resorting to a solution by successive approximations through repetitive substitutions in the same series of formulas.

Two generalized cases are given: one covering spur gears, and the other helical gears.

For given power requirements, the tooth data of a pair of spur or helical gears may be determined quickly and accurately and with a resultant good balance of material qualities between gear and pinion by using the formulas given herein. In most power problems of gearing, the given data are: the pinion r.p.m., horsepower required, and the reduction ratio. From these factors, the tooth data must be determined. The only preliminary assumptions that need be made in the use of the formulas presented herein are the number of pinion teeth, the pinion material and heat treatment, and in some instances, the face width. All of these assumptions can be made readily on the basis of good gearing practice and will be dealt with later.

For each separate case, four formulas are given: two based on **strength** of the tooth, and two based on **wear** of the tooth. When designing for strength alone it is necessary only to use the strength formulas; but when tooth wear is also to be considered, both, strength and wear formulas must be used and the limiting value used in the actual design. With identical material and heat treatment for both, the gear and pinion, it is necessary only to solve for pinion tooth data, as the pinion will be the weaker member.

The following nomenclature will be used throughout this article:

P —Diametral pitch (normal pitch if a helical gear)

A —Pressure angle factor (A = .85 for 14½°, A = 1 for 20° full depth, A = 1.2 for 20° stub)

S_b —Beam strength factor —Table 1

S_w —Surface wear factor —Table 1

X —Speed factor—Table 4

Y —Tooth strength factor—Table 2

Z —Ratio factor—Table 5

N —Number of teeth

H.P.—Horsepower to be transmitted

KP —A factor equivalent to diametral pitch —Table 3

F —Face width in inches

a —Helix angle

SPUR GEARS

General Case I: Spur Gears of Any Face Width

PINION

(1) Strength

$$P = .0028 \sqrt{\frac{S_b X Y N A F}{HP}}$$

(2) Wear

$$KP = \frac{S_w X Z N \quad A F}{126000 HP}$$

GEAR

(3) Strength

$$S_b = \frac{126000 HP P^2}{X Y N A F}$$

(4) Wear

$$S_w = \frac{126000 HP KP}{X Z N A F}$$

(*Continued on page 28*)

Note, in the nomenclature above, that tables 1, 2, 3, 4 and 5 are supplementary factors to the several formulas used.—*Ed.*

Table 2 STRENGTH FACTOR (Y)

No. OF TEETH ON MATING GEAR OR PINION →

No. OF TEETH ON GEAR OR PINION

HORSEPOWER OF WHICH IS REQUIRED →

	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	32	36	40	45	50	60	70	80	100	150	200
14–15									.505	.510	.520	.527	.530	.535	.542	.544	.555	.558	.560	.565	.575	.580	.590	.600	.620	.630	.640	.655	.670	.675
16									.515	.520	.530	.540	.545	.550	.555	.560	.570	.572	.573	.575	.590	.600	.610	.620	.640	.645	.655	.665	.678	.678
17									.520	.530	.540	.545	.550	.560	.565	.570	.573	.575	.580	.585	.600	.610	.620	.630	.645	.650	.660	.670	.682	.685
18									.530	.540	.550	.555	.560	.570	.573	.575	.580	.585	.590	.600	.610	.620	.630	.640	.650	.660	.670	.678	.690	.690
19									.540	.550	.560	.570	.573	.575	.580	.585	.590	.595	.600	.610	.615	.625	.635	.643	.650	.665	.680	.690	.695	.700
20	.390	.425	.450	.475	.495	.510	.525	.540	.550	.560	.570	.575	.580	.585	.590	.595	.600	.605	.610	.615	.625	.635	.645	.650	.665	.670	.680	.690	.703	.710
22	.410	.440	.470	.490	.510	.525	.545	.555	.565	.575	.580	.590	.600	.605	.610	.615	.620	.623	.625	.630	.640	.650	.660	.665	.675	.685	.695	.705	.720	.725
24	.425	.460	.485	.510	.530	.550	.560	.575	.580	.590	.600	.610	.615	.620	.625	.628	.630	.635	.640	.645	.655	.665	.675	.680	.690	.700	.710	.725	.735	.745
26	.440	.470	.500	.530	.550	.565	.580	.585	.600	.605	.620	.623	.625	.630	.640	.642	.645	.650	.655	.660	.670	.680	.690	.695	.708	.715	.725	.735	.750	.765
28	.455	.485	.520	.550	.560	.575	.590	.600	.615	.620	.630	.635	.640	.645	.650	.655	.660	.663	.665	.670	.680	.695	.700	.705	.715	.725	.730	.735	.750	.765	.775
30	.470	.500	.530	.560	.575	.590	.605	.615	.625	.630	.640	.650	.653	.655	.660	.665	.670	.675	.675	.680	.695	.700	.710	.715	.730	.740	.745	.750	.765	.775	.785
32	.480	.515	.550	.570	.585	.600	.615	.620	.635	.640	.650	.655	.660	.665	.670	.675	.680	.683	.685	.690	.700	.710	.720	.725	.740	.748	.755	.770	.780	.790
36	.500	.540	.565	.585	.605	.620	.635	.640	.650	.660	.670	.673	.675	.678	.680	.685	.690	.695	.700	.705	.715	.725	.730	.735	.748	.760	.765	.778	.790	.800
40	.525	.560	.585	.610	.625	.640	.652	.660	.665	.670	.680	.685	.690	.695	.700	.705	.708	.710	.715	.720	.725	.730	.740	.745	.760	.770	.775	.785	.800	.815
45	.550	.580	.600	.625	.648	.660	.665	.670	.680	.680	.690	.695	.700	.705	.710	.712	.715	.718	.720	.725	.730	.735	.745	.752	.765	.775	.780	.790	.810	.820
50	.565	.595	.620	.645	.658	.665	.675	.680	.685	.690	.700	.705	.710	.715	.718	.720	.723	.725	.728	.733	.735	.740	.750	.760	.770	.778	.783	.798	.815	.823
60	.590	.620	.650	.665	.670	.680	.685	.690	.700	.705	.710	.715	.718	.720	.723	.724	.725	.730	.732	.733	.735	.740	.750	.760	.775	.780	.790	.805	.818	.825
70	.615	.640	.660	.670	.680	.685	.695	.700	.710	.710	.715	.720	.723	.725	.727	.730	.733	.735	.735	.735	.743	.755	.765	.768	.778	.785	.793	.808	.820	.828
80	.625	.655	.670	.675	.685	.695	.705	.708	.715	.720	.722	.723	.725	.730	.732	.735	.736	.738	.738	.738	.745	.758	.768	.770	.780	.788	.795	.810	.823	.830
100	.650	.665	.675	.685	.698	.705	.710	.712	.720	.723	.725	.726	.730	.733	.735	.738	.739	.740	.740	.740	.750	.760	.770	.773	.783	.790	.800	.815	.825	.835
150	.670	.680	.690	.700	.702	.710	.715	.720	.723	.725	.730	.732	.735	.736	.740	.741	.742	.743	.743	.743	.755	.765	.773	.775	.785	.795	.805	.818	.828	.838
200	.675	.685	.700	.705	.710	.715	.720	.725	.726	.728	.735	.736	.738	.739	.742	.743	.744	.745	.745	.745	.760	.768	.775	.778	.790	.798	.808	.820	.830	.840

EXAMPLE 1: Design a pair of spur gears to transmit 25 horsepower at 1750 r.p.m. pinion speed, a 5 to 1 ratio is required. Wear must be considered and the face width is limited to 1 inch.

Assume that a 20-tooth pinion with 20° full depth teeth is to be used made of SAE 4620 steel case hardened and drawn to 645 Brinell.

From the tables, values for the pinion are: $S_b = 28000$, $S_w = 12000$, $X = 398$, $Y = .69$, $Z = 2.1$, $A = 1$.

Substituting in formulas (1) and (2):

$$P = .0028\sqrt{\frac{28000 \times 398 \times .69 \times 20 \times 1 \times 1}{25}} =$$

6.95 or 7 Pitch (1)

$$KP = \frac{12000 \times 398 \times 2.1 \times 1 \times 20}{126000 \times 25} = 63.68 \quad (2)$$

$$S_b = \frac{126000 \times 25 \times 7^2}{115.5 \times .72 \times 100 \times 1 \times 1} = 18{,}600 \quad (3)$$

$$S_w = \frac{126000 \times 25 \times 33.6}{115.5 \times 2.1 \times 100 \times 1 \times 1} = 4370 \quad (4)$$

From Table I, a material can now be chosen that meets these requirements. It is found that SAE 3140 heat treated to 388 Brinell will satisfy the requirements. The teeth in this gear can be finish cut after heat treatment. The fact that the pinion is limited by tooth strength indicates that the surface hardness of the tooth could be lower if desired.

SPECIAL CASE WHEN FACE WIDTH (F) IS PROPORTIONAL TO THE DIAMETRAL PITCH

In spur gearing, to obtain proper tooth contact and avoid undue wear or even failure of the teeth on the end nearest the applied power it has been found from experience that the face width should be proportioned to the size of the tooth. A value for face width (F) of $\frac{10}{P}$ has been found satisfactory. By substituting $\frac{10}{P}$ for F in formulas (1), (2), (3), and (4) a set of formulas will be derived that are more readily applicable in new design than those containing F.

These formulas become:

$$\text{PINION} \begin{cases} \text{Strength} & P = .043\sqrt[3]{\frac{S_b\ X\ Y\ N\ A}{HP}} & (5) \\ \text{Wear} & KP^2 = \frac{S_b\ X\ Z\ N\ A}{12600\ HP} & (6) \end{cases}$$

$$\text{GEAR} \begin{cases} \text{Strength} & S_b = \frac{12600\ HP\ P^3}{X\ Y\ N\ A} & (7) \\ \text{Wear} & S_w = \frac{12600\ HP\ KP^2}{X\ Z\ N\ A} & (8) \end{cases}$$

TABLE 3—PITCH WEAR FACTOR (K)

Diametral Pitch	K 14½°	K 20°	KP 14½°	KP 20°	KP² 14½°	KP² 20°
1	.732	1.0	.732	1.0	.732	1.0
1¼	.915	1.25	1.144	1.563	1.433	1.953
1½	1.025	1.40	1.535	2.10	2.31	3.15
1¾	1.135	1.55	1.985	2.71	3.47	4.743
2	1.245	1.70	2.49	3.40	4.98	6.80
2¼	1.39	1.90	3.13	4.27	7.05	9.62
2½	1.54	2.10	3.84	5.25	9.62	13.13
2¾	1.65	2.25	4.53	6.19	12.45	17.00
3	1.76	2.40	5.27	7.20	15.85	21.60
3½	1.98	2.70	6.92	9.45	24.2	33.10
4	2.24	3.05	8.95	12.20	35.83	48.80
5	2.68	3.65	13.35	18.25	67.0	91.25
6	3.08	4.20	18.45	25.20	110.8	151.2
7	3.52	4.80	24.6	33.60	172.0	235.2
8	3.88	5.3	31.0	42.40	248.0	339.2
9	4.28	5.85	38.5	52.65	347	473.8
10	4.65	6.35	46.5	63.50	465	635.0
11	5.02	6.85	53.6	75.35	607	829
12	5.38	7.35	64.5	88.2	776	1058
13	5.71	7.80	74.5	101.4	965	1318
14	6.05	8.25	84.7	115.5	1184	1617
15	6.42	8.75	96.3	131.25	1442	1969
16	6.73	9.20	107.6	147.2	1723	2355
17	7.10	9.70	120.8	164.9	2050	2803

EXAMPLE 2: Suppose that in the previous example $F = \frac{10}{P}$ was desired, all other conditions being the same. The values from the tables would be the same as in the previous example.

Substituting in formulas (5) and (6):

$$P = .043\sqrt[3]{\frac{28000 \times 398 \times .69 \times 20 \times 1}{12600 \times 25}} = 7.9 \text{ or } 8 \text{ Pitch} \quad (5)$$

$$KP^2 = \frac{12000 \times 398 \times 2.1 \times 20 \times 1}{12600 \times 25} = 636.8 \quad (6)$$

From table (3) the nearest KP^2 value below 636.8 is equivalent to 10 diametral pitch. In the actual design an 8 pitch 20-tooth pinion would be used as tooth strength is the limiting factor. Selecting values for the gear from the tables it is found that: $X = 115.5$, $Y = .71$, $Z = 2.1$, $KP^2 = 339.2$ and it is known that $N = 100$.

Substituting these values in formulas (7) and (8) it is found that $S_b = 19500$ and $S_w = 4400$. As in the previous example, SAE 3140 heat treated to 388 Brinell would be satisfactory. The face width of this pair would be $\frac{10}{P} = \frac{10}{8} = 1.25$ or $1\frac{1}{4}$ inch. It is evident from this example that formulas (5) and (6) are more useful than formulas (1) and (2) in the previous case. An assumption for face width may prove too large in proportion to the calculated pitch.

HELICAL GEARS

The formulas stated below for helical gears give good results when the helix angle (a) is 20° or greater. This insures complete overlap of tooth contact in most cases. The helical gear formulas take into account the increase in strength and wear qualities due to the helix angle and the sloping lines of tooth contact. They are used in a like manner to those for spur gears, except, that to determine the Y value from table (2) the virtual number of teeth is used. The virtual number of teeth $= \frac{N}{\cos^3 a}$

GENERAL CASE II: HELICAL GEARS OF ANY FACE WIDTH

$$\text{PINION} \begin{cases} \text{Strength} & P = .0031\sqrt{\frac{S_b\ X\ Y\ N\ A\ F\ \cos a}{HP}} & (9) \\ \text{Wear} & KP = \frac{S_w\ X\ Z\ N\ A\ F}{126000\ HP\ \cos^2 a} & (10) \end{cases}$$

$$\text{GEAR} \begin{cases} \text{Strength} & S_b = \frac{104000\ HP\ P^2}{X\ Y\ N\ A\ F\ \cos a} & (11) \\ \text{Wear} & S_w = \frac{126000\ HP\ KP\ \cos^2 a}{X\ Z\ N\ A\ F} & (12) \end{cases}$$

EXAMPLE 3: Design a pair of helical gears to transmit 10 horsepower at 1800 r.p.m. pinion speed. An output speed of 800 r.p.m. is required. The face width is limited to 2" and 1020 rolled steel is the only available material.

A pinion of 30 teeth, 14½° pressure angle, and 25° helix angle can be assumed. Since both, pinion and gear, are of the same material and hardness, only the pinion need be checked.

From the tables values for the pinion are: $S_b = 14500$, $S_w = 1500$, $X = 406$, $Z = 2.5$, $A = .85$. The virtual number of teeth $= \frac{N}{\cos^3 a} = \frac{30}{\cos^3 25°} = 40 +$, so $Y = .78$.

Substituting in (9) and (10):

$$P = .0031\sqrt{\frac{14500 \times 406 \times .78 \times 30 \times 2 \times .85 \times \cos 25°}{10}} =$$

$$= 14.3 \text{ or } 14 \text{ Pitch}$$

$$KP = \frac{1500 \times 406 \times 2.5 \times 30 \times .85 \times 2}{126000 \times 10 \times \cos^2 25°} = 73.8$$

The nearest KP value below 73.8 in table 5 is equivalent to 12 diametral pitch. In the actual design a 12 pitch, 30-tooth pinion would be used. The gear would have 67 or 68 teeth.

In this example, there is quite a difference in the pitch required for strength and the pitch required for wear. This occurs due to the use of a soft material with no heat treatment. The pitch is limited by wear when the softer materials are used. If this pinion were casehardened the pitch would be 16 and be limited by tooth strength, rather, than wear.

The $14\frac{1}{2}°$ pressure angle was chosen in this case because of the limited face width since this lower pressure angle gives a longer arc of contact than a $17\frac{1}{2}°$ or 20° angle. This angle, along with the 25° helix angle and soft material, makes for quiet, smooth running gears. If a different material had been used for gear and pinion, the S_b and S_w values for the gear would be determined by formulas (11) and (12).

The face width of a helical gear need have no definite relation to the pitch for satisfactory operation. It has been found that a value of face width equal to the pitch diameter of the pinion gives good all-around proportions. Since the pitch diameter = $\frac{N}{P \cos a}$, this value can be substituted in formulas (9) and (10) and pinion formulas obtained which, as before, are more readily applicable to new design problems. Since the face width is proportional to the pinion pitch diameter, formulas (11) and (12) are used as before for the gear.

These formulas are:

PINION { Strength $P = .0212 \sqrt[3]{\frac{S_b \, X \, Y \, A \, N^2}{HP}}$ (13)

PINION { Wear $KP^2 = \frac{S_w \, X \, Z \, A \, N^2}{126000 \, HP \cos^3 a}$ (14)

GEAR { Strength — Use Formula (11)

GEAR { Wear — Use Formula (12)

EXAMPLE 4: Design a pair of helical gears to transmit 20 horsepower at 1200 r.p.m. pinion speed. An output speed of 400 r.p.m. is required. A pinion of 30 teeth with a 20° normal pressure angle and 30° helix angle can be assumed. SAE 1040 heat treated to 262 Brinell with teeth cut after heat treatment would be a satisfactory pinion material.

From the tables values for the pinion are: $S_b = 29000$, $S_w = 3200$, $X = 300$, $Z = 2.7$, $A = 1$. The virtual number of pinion teeth $= \frac{30}{\cos^3 30°} = 46+$, so $Y = .8$

Substituting in formulas (13) and (14):

$$P = .0212 \sqrt[3]{\frac{29000 \times 300 \times .8 \times 1 \times 30^2}{20}} = 14.4 \text{ or } 14 \text{ Pitch}$$

$$KP^3 = \frac{3200 \times 300 \times 2.7 \times 1 \times 30^2}{126000 \times 20 \times \cos^3 30°} = 1425$$

The nearest KP^2 value below 1425 in table (3) is equivalent to 13 pitch. The pinion is limited by wear, so in the actual design a 13 pitch, 30-tooth pinion would be used. The face width would be equal to the pitch diameter or $\frac{N}{P \cos a} = \frac{30}{13 \cos 30°} = 2.76$, or say $2\frac{3}{4}$".

The material characteristics for the gear can now be determined by formulas (11) and (12).

TABLE 4—SPEED FACTOR (X)

RPM	X	RPM	X	RPM	X	RPM	X
5	2.95	100	42.0	600	177.0	1750	398.0
10	5.6	150	58.5	650	188.5	2000	440.0
20	10.4	200	74.0	700	199.5	2500	512.5
30	15.0	250	88.7	750	211.5	3000	591.0
40	19.2	300	102.0	800	223.2	3500	665.0
50	23.5	350	115.5	850	233.5	4000	724.0
60	27.3	400	128.0	900	243.0	4500	796.0
70	31.15	450	139.0	950	252.0	5000	875.0
80	34.8	500	152.5	1000	260.0	5500	946.0
90	38.25	550	165.0	1500	353.0	6000	1020.0

From the tables, values for the gear are: $X = 128$, $Z = 2.7$, $A = 1$, $KP = 101.4$, and it is known that $N = 90$. The virtual number of teeth $= \frac{N}{\cos^3 a} = \frac{90}{\cos^3 30°} = 138+$, so $Y = .78$

Substituting in formulas (11) and (12):

$$S_b = \frac{104000 \times 20 \times 1.3^2}{128 \times .78 \times 90 \times 1 \times 2.75 \times \cos 30°} = 16400$$

$$S_w = \frac{126000 \times 20 \times 101.4 \times \cos^2 30°}{128 \times 2.7 \times 90 \times 1 \times 2.75} = 2240$$

Since S_b is equal to $\frac{1}{3}$ of the yield point, a material having a yield point of about 49200 p.s.i. would suffice. By referring to table (6) it is found that a Brinell hardness of around 200 would be satisfactory. This softer material would tend to be cold-worked by the harder pinion. This pair of gears, if mounted rigidly in good bearings on the proper center distance and provided with adequate lubrication, would be very quiet running and have a long life.

TABLE 5—RATIO FACTOR (Z)

	Inverse Ratio = $\frac{\text{No. Pinion Teeth}}{\text{No. Gear Teeth}}$									
No. of Pinion Teeth	.1	.2	.3	.4	.5	.6	.7	.8	.9	1.0
10	1.3	1.1	1.0	.9						
15	1.75	1.6	1.5	1.4	1.3	1.2	1.1	1.05	1.0	
20	2.25	2.1	1.9	1.8	1.7	1.6	1.5	1.4	1.3	1.25
25	2.7	2.5	2.35	2.2	2.05	1.9	1.8	1.7	1.6	1.55
30	3.15	2.9	2.7	2.6	2.4	2.25	2.15	2.05	1.9	1.85
35	3.7	3.4	3.2	3.0	2.8	2.65	2.5	2.4	2.25	2.15
40	4.1	3.8	3.5	3.3	3.1	2.9	2.75	2.6	2.5	2.4
45	4.5	4.2	3.9	3.65	3.4	3.2	3.05	2.9	2.8	2.65
50	4.9	4.6	4.3	4.0	3.8	3.6	3.35	3.2	3.05	2.9
55	5.3	4.9	4.65	4.35	4.1	3.9	3.65	3.45	3.3	3.15
60	5.75	5.35	4.95	4.65	4.4	4.15	3.95	3.75	3.55	3.4
65	6.2	5.7	5.35	5.0	4.7	4.45	4.25	4.05	3.85	3.65
70	6.6	6.15	5.85	5.35	5.0	4.75	4.55	4.35	4.1	3.9
75	7.0	6.5	6.05	5.65	5.35	5.05	4.8	4.6	4.4	4.2
80	7.4	6.9	6.4	6.0	5.65	5.3	5.05	4.8	4.6	4.45
85	7.75	7.25	6.8	6.35	5.95	5.6	5.3	5.05	4.8	4.65
90	8.1	7.6	7.1	6.7	6.3	5.9	5.6	5.3	5.1	4.9
95	8.5	7.95	7.45	7.0	6.6	6.2	5.9	5.6	5.3	5.1
100	8.9	8.3	7.8	7.3	6.9	6.5	6.15	5.85	5.6	5.35

TABLE 6— w EQUIVALENT TO BRINELL HARDNE S

Brinell	Sw	Brinell	Sw	Brinell	Sw
140	1500	260	3200	450	5000
160	1700	280	3400	500	7000
180	2000	300	3700	550	9000
200	2400	340	4000	600	10500
220	2700	380	4200	650	12000
240	3000	400	4500	700	13000

The Sb (beam strength factor) value is equal to $\frac{1}{3}$ of the yield point of the material.

The fundamental rules of good gear design should govern any assumptions made for the number of teeth, pressure angle, and material. The minimum tooth numbers that should be used are as follows: for 14½° full depth—30, for 20° full depth—18, for 20° stub—14 teeth. Smaller tooth numbers are often used on helical gears or spur gears using special tooth forms. For a given diameter the helical gear usually has more teeth of a finer pitch than the spur gear. This makes for quieter running, but the profile and pitch errors must be held to closer tolerances to avoid excessive dynamic loading. In higher speed gearing, the softer materials and helical tooth form are more generally employed. This allows teeth to be cut after heat treatment. The formulas presented in this article are applicable to general purpose spur and helical gear design for pitch line speeds up to 3000 feet per minute. For higher speeds, it is recommended that more specialized formulas be used.

Gear Inspection

by A. D. F. Monerieff

Quiet, smooth running gears result from intelligent design and accurate workmanship. It is necessary to have suitable, dependable checking equipment and inspectors skilled in their use. It has been erroneously thought that inspection of the gear begins after the teeth are cut; however, it is often too late to make a good gear or to rectify mistakes if control starts at this point. To insure accuracy, in gears, it is necessary to inspect and control all factors relative to the finished product. And this begins with the material.

A. D. F. Moncrieff **joined Michigan Tool Co. as an apprentice and, after several years in the shop, was made machine tool demonstrator. In the latter capacity, he demonstrated gear shaving and checking equipment, and gear cutting tools, in England, France, Germany and Belgium. Having studied engineering at Wayne University and through the I.C.S., he assisted in cutter and hob design until appointed Ass't Chief Engineer of Michigan Tool Co. in 1943.**

Well run gear shops take chemical analysis of the steel and only accept materials meeting their specification. If it is impossible to use this method of control, test pieces are hardened out of each shipment. The test pieces are inspected for heat treat distortion so that allowances can be made for gears run in regular production. Compensation, for heat treat distortion, depends on the method of hardening used.

As a general rule, helical gears have a tendency to straighten out or "unwind" during hardening. The amount of distortion, in this respect, depends on types of steel and heat treatment and can only be determined by trial. Carburized gears have a tendency to broaden out at the base of the teeth, while cyanide treated gears will have the tendency of broadening at the tip. Allowances can and must be made for the various types of distortions encountered.

Obtaining accurate gears can only be accomplished through the proper application of gear inspection procedures. All too often, failures to meet specifications after heat treat are blamed entirely on heat treat distortion rather than on inaccuracies introduced before heat treating.

Before teeth can be cut accurately it is necessary to see that holes are accurate, that they are accurately centered, and that locating surfaces are square with the hole. Gears integral with a shaft should have protected centers and be inspected to see that the centers are not nicked and are free of foreign matter. Unless these factors are given proper attention, the gear will be inaccurate regardless of the care exercised in cutting the teeth. If the locating surfaces or sides of the gear are not square with the bore the gear blank will be cramped on the generating machine so that an excessive runout is introduced. As an eccentric condition can seldom be corrected by subsequent grinding of the bore, it is far better to control the gear blank and prevent eccentricity from occurring.

In checking gears, as in checking other mechanical parts, we are limited as to the accuracy of our check to the accuracy of the inspection tools. In recognition of this fundamental, gear inspection equipment, while basically simple

FIG. 1. Checking the involute form. Michigan Sine-Line Model 1124 Involute Checker illustrated.

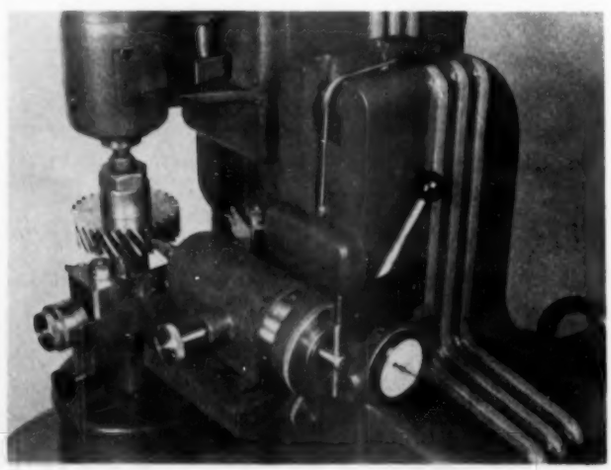
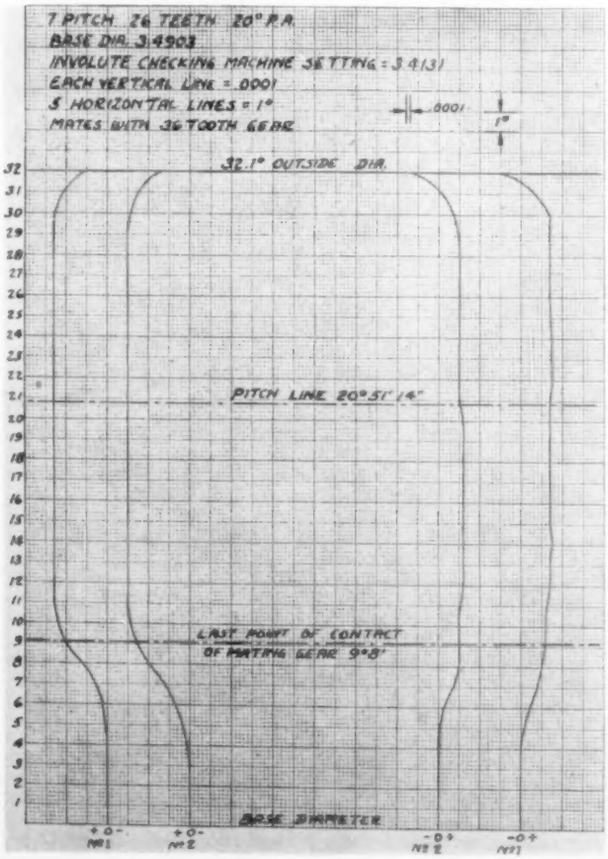


FIG. 2. Manually plotted chart, showing the involute profile of right and left hand surfaces of two gear teeth on a 7-pitch gear.


7 PITCH 26 TEETH 20° P.A.
BASE DIA. 3.4903
INVOLUTE CHECKING MACHINE SETTING = 3.4131
EACH VERTICAL LINE = .0001
5 HORIZONTAL LINES = 1°
MATES WITH 36 TOOTH GEAR
.0001
1°
32.1° OUTSIDE DIA.
PITCH LINE 20°51'14"
LAST POINT OF CONTACT OF MATING GEAR 9°8'
BASE DIAMETER

and of rugged dependable construction, lays major stress on achieving laboratory exactness without sacrificing versatility.

To produce gears that are quiet and therefore accurate, it is also necessary to control several other elements. Among the more essential are: tooth profile; tooth spacing; helical lead and spur gear tooth alignment; size and concentricity. Inspection for all of these should be supplemented by a final inspection consisting of sound testing of the completed gear on a speeder.

Tooth Profile

In order to transmit motion smoothly and quietly it is essential that the tooth profile be of uniform cam rise. Any portion of the tooth above the base diameter can be in contact with mating teeth provided the involute is perfectly formed. To allow for manufacturing tolerances, the involute form is sometimes modified. Modification may be at the tip of the tooth—to ease contact between the tip of the tooth and flank of the mating tooth—or, the flank of the tooth immediately above the base may be modified or undercut since this portion of the involute is most difficult to control and to check. A gear should never be modified to such an extent that continuous tooth action is impaired. As mentioned above, quietness in gearing is dependent on smooth continuous contact action of mating tooth profiles.

To check the tooth profile, an involute checker, as shown in Fig. 1, may be used. This type of checking instrument works on a sine bar principle, eliminating the use of master forms, or multiple master base circle discs.

The gear to be checked is mounted between centers and an indicator finger is brought into contact with the tooth profile. The movement of the finger and rotation of the gear are synchronized so that for one degree of rotation the indicating finger moves $\frac{1}{360}$ part of the circumference of the base diameter of the gear being checked. The involute checker is operated by a hand wheel, each turn of which equals 2° rotation of the gear.

There are various means of recording the readings obtained from an involute checker. One form of record is shown in Fig. 2. Note that the charted lines on the left side of the chart have a plus sign on the left side of the vertical centerline of the graph. The charted lines on the right side have the plus and minus symbols reversed. The chart is set up in this manner to give the impression of looking at a cross section of a gear tooth.

The horizontal line at the bottom of the chart represents the base circle of the gear being checked. The gear rotates

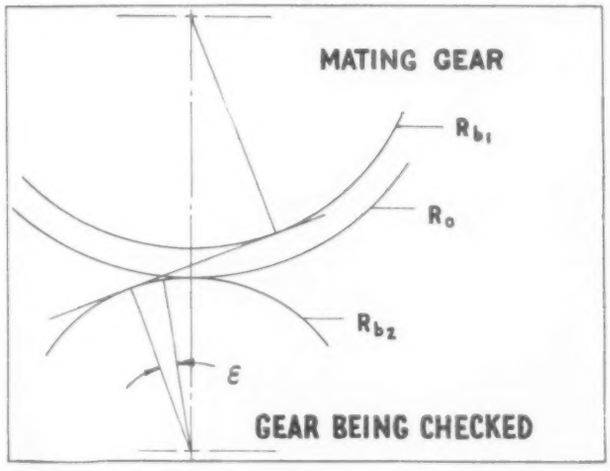


FIG. 3. Method for finding last point of contact of mating gear in number of degrees above the base circle.

ε = DEGREES OF ROLL FROM BASE
C = CENTER DISTANCE
ϕ = AXIAL PRESSURE ANGLE
R_o = OUTSIDE RADIUS OF MATING GEAR
R_{b1} = BASE RADIUS OF MATING GEAR
R_{b2} = BASE RADIUS OF GEAR BEING CHECKED

$$\text{RADIANS } \varepsilon = \frac{C \sin \phi - \sqrt{(R_o + R_{b1})(R_o - R_{b1})}}{R_{b2}}$$

EXAMPLE:- RADIANS ε =

$$= \frac{3.08585 \sin 20° - \sqrt{(1.885 + 1.678)(1.885 - 1.678)}}{1.2062} =$$

$$= \frac{3.08585 \times .3420201 - \sqrt{.737541}}{1.2062} =$$

$$= .1630083$$

$$\varepsilon = 9°20'23''$$

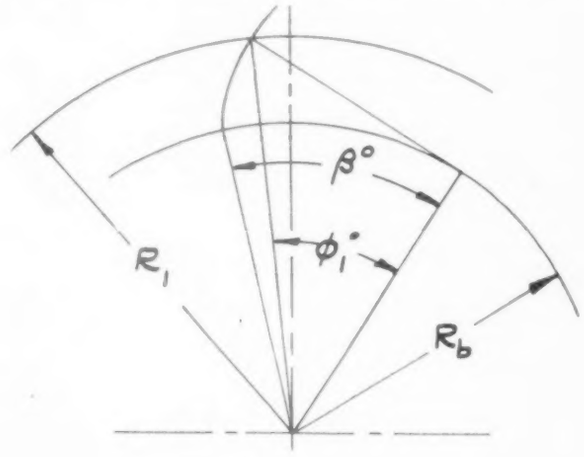


FIG. 3a. Method for finding the degrees of roll from the base diameter to any other diameter.

R_b = BASE RADIUS
R_1 = ANY CHOSEN RADIUS
ϕ_1 = P.A. AT R_1
β = DEGREES OF ROLL
C = 57.2957795

FORMULAS:- $\cos \phi_1 = \frac{R_b}{R_1}$; $\beta° = \tan \phi_1 \cdot C$

EXAMPLE:- GIVEN: R_b = 1.6780 R_1 = 1.8850

$$\cos \phi_1 = \frac{1.6780}{1.8850} = .8901856$$

$\phi_1 = 27°.1034214$ $\tan \phi_1 = .5118012$

$\beta° = .5118012 \times 57.2957795$

$\beta° = 29°.3240487$

while it is checked, offering a basis for location of the last point of contact of the mating gear, the pitch line, and the outside diameter, of the gear being checked. At the left of the chart, degrees of rotation are given. Horizontal lines indicate the last point of contact, the pitch line and the outside diameter. The vertical lines of the graph each represent .0001 inch.

The lines are plotted by taking indicator readings every degree or every two degrees as required. If a perfect involute were charted the resultant graph line would be straight.

FIG. 4. Michigan automatic recorder used in conjunction with Michigan Sine-Line Checking machines for automatic permanent recording.

Referring to this sample chart, it will be noted that the involute of the gear checks within one tenth of a thousandth from 11° to 30°. From 30° to the O.D. there is a modification of approximately one thousandth, also, there is a modification of .0012" to .0015" 11° to the base circle. Interpretation of the chart would indicate a gear that should operate very satisfactorily, there being a modification below the active portion of the involute and a modification of a few tenths at the O.D. to ease contact with the mating gears as the teeth of the gear being checked come into mesh.

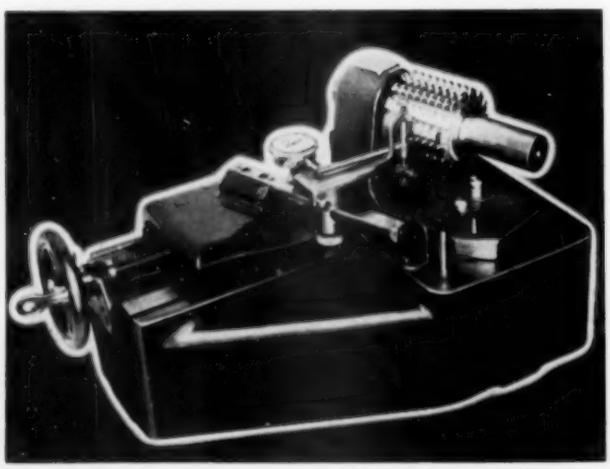
Fig. 3 is a formula used to find the last point of contact of the mating gears in number of degrees of rotation of the gear on the checker. Formulas for location in degrees of roll of the pitch line and outside diameter are given in Fig. 3a. Shaper cutters also may be checked on the involute checking machine, as well as master gears, plugs and involute splines.

Automatic recording of involute checks may be accomplished readily by the use of a recorder such as shown in Fig. 4. This recorder is interconnected with the involute checker. However, it may be used with virtually any Michigan checking machine or combination of checking machines. The recorder is shown, in Fig. 7, connected with a base pitch and space checking machine.

Hob Contour Checking

For control of the profile of hobs, a hob contour checker such as is shown in Fig. 5 may be used. However, this simple tool—which also works on the sine-bar principle—is limited in use to inspection of hob and worm profiles.

FIG. 5. Hob contour checker, Michigan Sine-Line Model 464, used for the inspection of hob and worm profiles.



The hob is mounted on an arbor integral with a sine-bar table which is adjusted to the proper angle. A knife edge contact finger is brought into contact with the hob tooth profile and moved across the tooth surface to indicate irregularities.

Use of a hob contour checker facilitates inspection of hobs for correct pressure angle and thus assures the user that all hobs for the same job will be of identical tooth shape.

Tooth Spacing

Errors in tooth spacing, of course, result in noisy gears since the teeth will move into and out of engagement in such a manner as to produce uneven rotation. The impact of unequal tooth spacing frequently results in undue wear and subsequent failure because of the uneven distribution of tooth loads. Tooth spacing is best checked along the line of action between two gears. The distance between adjacent involutes along the line of action is known as the base pitch.

Tooth spacing as well as tooth form can be checked on an involute checking machine (see Fig. 6). The indicator contact finger is located tangent to the base circle (on the line of action). The positive stop is located on the line of action to contact against the side of an adjacent tooth. Thus, spacing is checked along the line of action and the distance between the contact finger and positive stop is equal to the base pitch of the gear being checked. In cases where the root diameter is above the base diameter, as shown in Fig. 6a, the contact finger and positive stop are moved tangent to

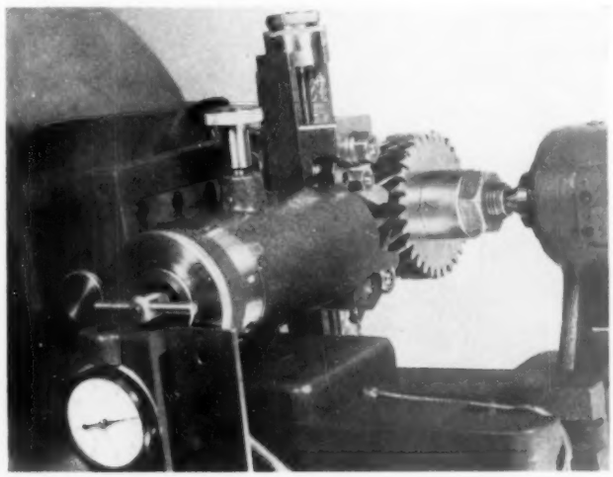
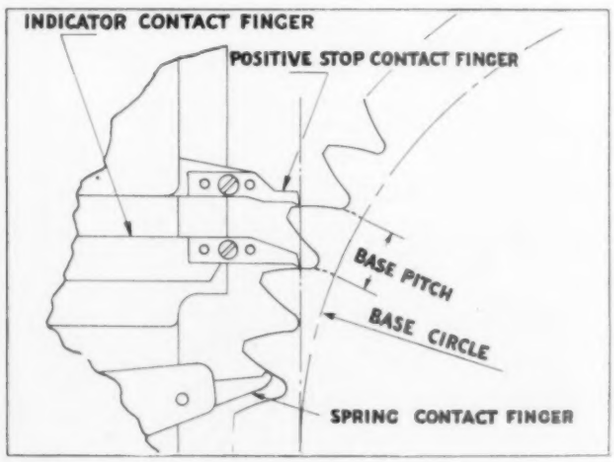


FIG. 6. Checking tooth spacing on the Michigan 1124 Sine-Line Involute Checker.

FIG. 6a. Showing contact of Base Pitch and Space Checking contact fingers when base circle is below tooth profile.



the base circle without disturbing their position relative to each other, until they are located in proper contact with the gear teeth.

Another means of checking base pitch and tooth spacing independent of the involute checking machine is shown in Fig. 7. On this production checker, spacing is also checked along the line of action as described above. On this machine, automatic indexing and the possibility of using an automatic recorder for checking space is available.

Helical Gear Lead and Spur Gear Tooth Alignment Checking

Misalignment of tooth surfaces, either in spur or helical gears, may appear in the form of tapered teeth causing an end bearing, or, a condition of mismated helices may occur. The latter shows up as a crossed bearing in mating gears. These conditions result in uneven distribution of tooth loads with resulting noise and possible gear failures.

To avoid the conditions outlined above, checking parallelism of spur gears or lead of helical gears is an absolute necessity. Checking lead offers the possibility of compensating for errors arising from distortion or an unwinding of the helix during heat treatment. In most cases, helical gears are shaved with a short lead to pre-correct for this condition. Nevertheless, checking the finished gear is still necessary in order to control the amount of pre-correction.

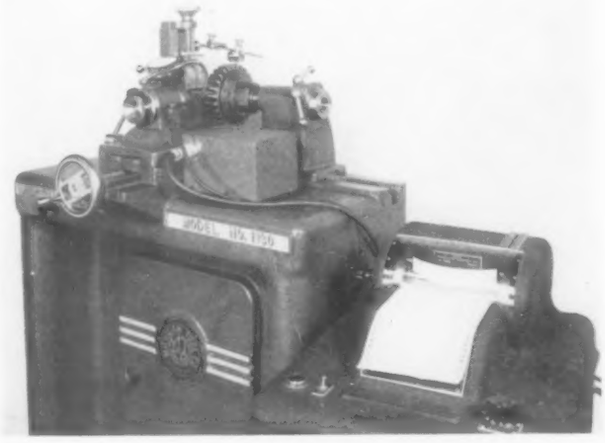


FIG. 7. Checking tooth spacing on the Michigan Model 1130 Spacing Checker and automatically recording the data on the Michigan AY-1 recorder. Automatic indexing of the gear is a feature of the 1130 Spacing Checker.

FIG. 8. This Michigan Model 1205 Sine-Line Lead Checker will check leads of gears from zero to infinity.

A machine that will check helix angles from zero to infinity is shown in Figs. 8 and 8a. It may be used for helical, worm or spur gears. The gear is placed between centers and an indicating finger brought into contact at any desired depth on the gear tooth. The finger is integral with a ball mounted table which moves parallel to the face of the gear being checked. Movement of the indicator finger and rotation of the gear are synchronized by setting an adjustable sine-bar. The operation of the machine is accomplished by turning a single handwheel. Errors in alignment are read on a 1/10,000 indicator or may be recorded permanently through the use of the Automatic Recorder shown in Fig. 4.

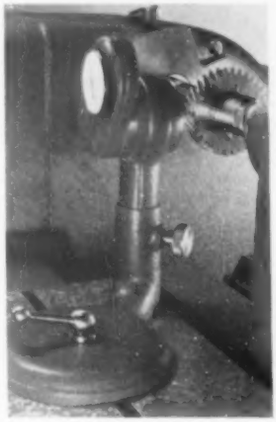


FIG. 8a. Closeup of the Michigan 1205 checking lead on a helical gear.

A machine which provides a means of quickly and accurately checking lead in gears in production is shown in Fig. 9. It is particularly useful in shops employing large numbers of shaving machines, to facilitate setting the crossed-axis angle on the shaving machine.

This single purpose type checker has all working parts completely enclosed, to protect the checker from dust and grit. It also makes it difficult to tamper with the set-up. Through the use of this checker an unvarying and accurate day to day check can be obtained.

The machine employs a master lead equipped with 3 or 4 starts equally spaced about its periphery. An indicator is placed in contact with one of the gear tooth surfaces and the gear is guided past the indicator by a master lead. Both the gear and master lead are mounted on a single spindle. Without changing the position of the gear on the spindle three or four teeth can be checked, depending on the number of starts on the master.

Hob Lead Checking

Variation in the lead of a hob will of course introduce errors in the profile of the gear being hobbed. For example, suppose a hob has 60 teeth, 25 of which comprise the cutting zone (see Fig. 10a) when producing a given gear. Of the 25, perhaps 10 serve as roughing teeth only, and the remaining 15 actually generate the finished tooth profile. Each of these

FIG. 9. Checking lead on both internal and external helical gears is shown in this view of two Michigan Model 1200 single purpose lead checkers.

15 teeth must arrive at their correct position at the correct time otherwise the portion of involute for which they are accountable will not be correctly generated.

In considering the above it would seem advisable to use a checking machine to determine (before the hob is used) whether or not the 15 teeth in the example above will arrive at their designated position at the right time when hobbing a gear.

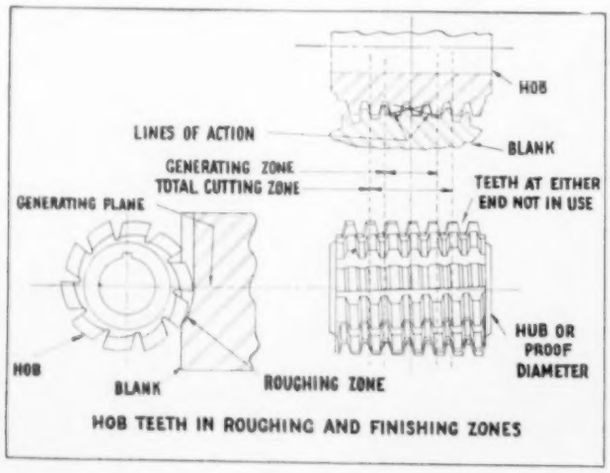
It is known that contact between an involute profile and straight sided rack tooth occurs only along a straight line. This straight line is known as the line of action between a hob and the gear being generated.

To check lead and line of action of a hob, a hob and worm lead checker as shown in Fig. 10 may be used. In this "Sine-Line" machine a new method of hob inspection and control was introduced, offering a composite test for hobs. A supplementary sine-bar imparts motion to the indicator contact finger at right angles to motion imparted by the first sine-bar. Thus, leads of worms and hobs that fall between zero and 18° may be checked by using the first sine-bar. Line of action checks on the same hobs are obtained through the simultaneous use of both sine bars.

While checking the line of action, all elements of hob accuracy are checked simultaneously. If the hob checks to given tolerances it may be expected to produce an accurate gear, provided it is mounted in the same position in which it was checked and errors introduced by the hobbing machine are negligible.

FIG. 10. Either the lead or the line of action of a hob may be checked on the Michigan Model 874 Sine-Line Hob Checker.

FIG. 10a. Showing hob teeth in roughing and finishing zones.



Size and Concentricity

If the size of gears varies materially they will not mate on the proper center distance, or the gears are liable to bind in operation due to heat expansion. On the whole, more backlash is preferable to less, although it is not necessary to hold the backlash tolerance to an extremely close limit.*

Eccentricity is usually objectionable from the noise standpoint. An eccentric sound under load or a rattle when the gears are running idle is likely to occur. In cases where the gears are extremely eccentric, failure because of binding may result.

A testing machine of the type shown is an all-around useful machine for checking gear size over rolls, eccentricity over a pin, and parallelism of spur gear teeth. In addition, all pertinent elements affected when sharpening a hob or milling cutter can be inspected on this machine.

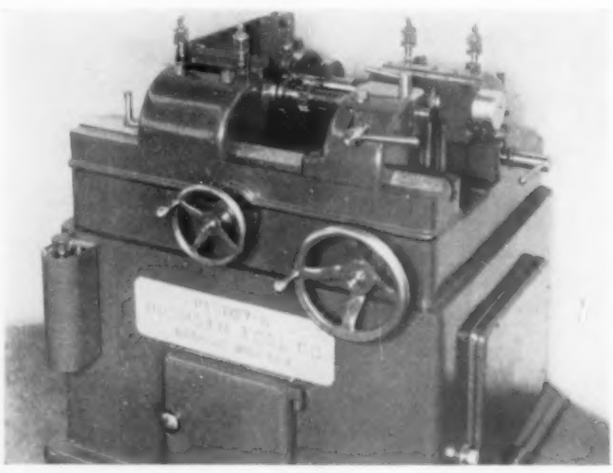
In appearance this machine resembles bench centers with several attachments, which can be mounted on an auxiliary table. The table is capable of being moved accurately parallel to the line of centers and at right angles to the line of centers. This machine is shown in Fig. 11 checking sharpening of a hob.

*More detailed information on AGMA Backlash may be had on Page L-28, Michigan Tool Co. catalog.

All checking equipment illustrated in this article is manufactured by Michigan Tool Co., Detroit, Mich.

FIG. 11. Checking hob sharpening on the versatile Michigan Model 471 Hob Checker.

FIG. 12. The gear speeder test, as shown on this Michigan Model 1127-B Speeder, allows the inspector to locate noisy gears before assembly.



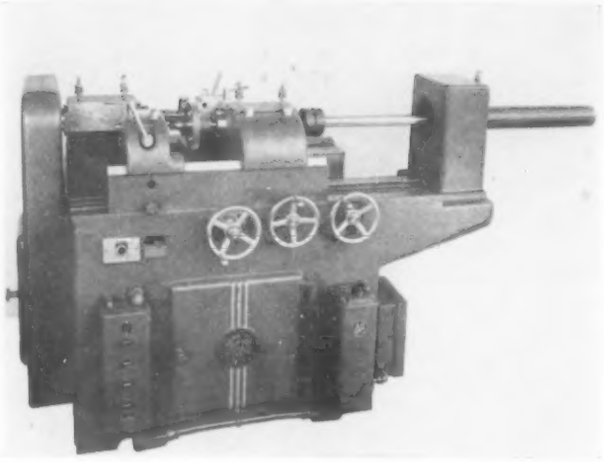


FIG. 13. Designed for sound testing larger mating gears, the Michigan 1129 Speeder offers pre-assembly control of noisy gears.

Gear Speeder Test

There is really only one final check on whether a gear is good or bad, whether it has been made right or not, and that is on the basis of how it will operate in actual service. Since checking of individual gears in operation is obviously impossible in production, it seems evident that the best thing to do is check every gear, or at least spot check every few gears, on a speeder designed to duplicate as nearly as possible actual operating conditions.

Though individual errors may cause noise in operation, it is the combined effect of all errors that show up in a gear speeder test. Sometimes errors in one element can be offset by other errors and the result is a passable gear.

A speeder developed to meet virtually every demand for running two mating gears is shown in Fig. 12. This speeder is equipped with a drive mechanism which may be applied to either spindle, while a brake load is applied to the spindle holding the mating gear. However, with each spindle turning in the same direction, the driving and braking action may be reversed to simulate action of a car transmission under drive and coast conditions. Four spindle speeds are provided ranging from 580 to 1740 r.p.m.

Fig. 13 shows another speeder designed for testing of larger gears. This speeder provides a range of speeds from 580 to 1800 r.p.m. and will take gears of a maximum diameter of 13 inches.

Installment No. 5, which will conclude this symposium, will follow in the May issue, THE TOOL ENGINEER.—*Ed.*

Shaving Facilitates Camshaft Production

Manufacture of automotive camshaft is time consuming and difficult because of inherent design limitations and the high accuracy required. The most critical element, from a manufacturing standpoint, is the distributor or oil pump gear which is an integral part. The forming of this gear has been greatly facilitated by shaving as designed by *National Broach and Machine Co.*

These gears differ from conventional transmission and timing gears in that because of right angle drive they have an extremely high helix angle and are often obstructed by adjacent shoulders or the cam lobes themselves. These gears range usually from 12 to 16 N.D.P., 14½ P.A. and 50° to 60° helix angle. Such gears fall into three general classes from a manufacturing standpoint:

1—"Open" gears, the root diameters of which are greater than adjacent shoulder diameters and cams far enough removed to present no obstacle to the gear cutter. "Open" gears are hobbed in the conventional manner.

2—Gears having adjacent shoulder or cam element so close that only "Plunge Hobbing" is practicable as a method of cutting. This necessitates the feeding of the hob straight into the work without any axial traverse.

3—Gears having slightly more clearance to the nearest obstacle than in Class 2, thus permitting some traverse of the cutter when the gear is being "Plunge Hobbed."

There are certain limitations to "plunge hobbing" which produces a concave tooth and root and leaves the tooth thicker at the ends than in the center. In operation, these thick ends dig into mating teeth, especially if there is any axial displacement or helix angle errors.

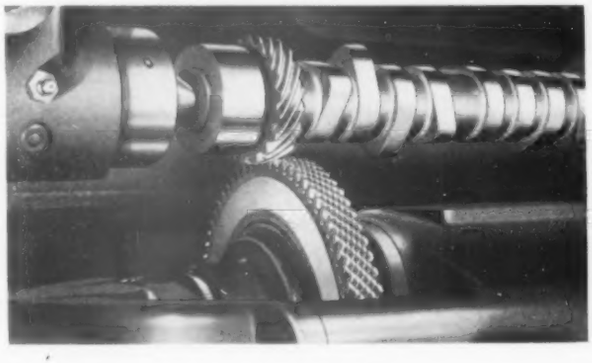
Gear teeth, when plunge ground, are not completely generated and thus contain errors in involute form, spacing and helix angle. When a slight traverse is possible while "plunge hobbing," a small flat is left on the gear teeth which improves tooth contact in service but does not remedy all plunge hobbing difficulties. Any of the three classes of gears mentioned above may be shaved, using a suitable cutter, at rates of 30 to 40 per hour for ordinary truck and automotive camshafts.

Shaving corrects errors in involute form, tooth spacing, eccentricity, helix angle and, when necessary, it straightens concave tooth sides. It permits modification, where desirable, to reduce gear noise and facilitate assembly, and can also be regulated to compensate accurately for heat treat distortion. And, both cast and forged gears can be shaved with equal effectiveness.

While small lead errors of helical gears driving at a 90° angle is not considered as serious as it is in similar gears having parallel axes, an excessive lead error with a high helix angle adversely affects involute form. This is corrected by shaving. Another important advantage of shaving is the improvement in tooth surface smoothness.

The great amount of sliding action in operation, together with the reduced contact area inherent in gears of this type, is very apt to result in galling and gouging in service unless tooth surfaces are very smooth.

Gear shaving solves difficult problem in camshaft manufacture.



By P. H. Winter

Elements of Electric Circuits

An Article of Timely Interest in View of the Sharp Trend Toward Electric and Electronic Control of Manufacturing Equipment

The ever increasing use of hydraulically and air operated machines, tools and mechanisms has brought with it a wide application of electrical circuits to control the cylinders, motors, pumps and valves that go into hydraulic and pneumatic units. And, because some designers still shy away from the use of electrical controls due to unfamiliarity with their possibilities, it is the purpose of this article to acquaint the uninitiated with their principles.

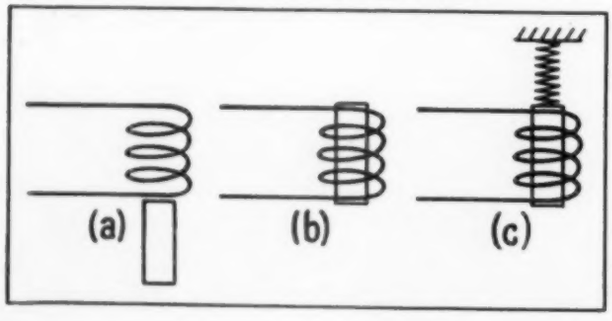
Paul H. Winter **gained practical experience as an apprentice, building Diesel engines, in London, England. There, he attended the University of London, later graduating with engineering degree from Carnegie Tech. After service with Heald Machine Co., and with Sperry Gyroscope Co., as chief methods engineer, he joined the LaSalle Engineering Co., of which he is executive engineer. He is a member of Greater New York Chapter, A.S.T.E.**

In order to operate, every electrical device must be connected, at least at two points, to the current conductors—usually wires known as terminals. The most important items, in machine control, are switches, solenoids and a combination of the two known as relays.

Fundamentally, a switch is a mechanism attached to the ends of two conductors (wires) and a moveable part that either connects or disconnects the two conductors, thereby permitting or disconnecting the flow of electric current. A switch that permits the passage of current is known as a closed switch; a switch interrupting the passage of current is known as an open switch.

If the switch is so designed that it will be either open or closed if acted upon by an outside force, it is said to be either normally open or normally closed respectively. As examples are the various types of limit switches that only close or open when pressure is applied to a plunger or roller. A switch with two sets of contacts, one of which is open while the other is closed—and vice versa—is known as a double throw switch.

FIG. 1. Principles of the pull type solenoid.



Switches are designed to handle certain current loads which must not be exceeded if the contacts (the points at which the current passes from one member to another) are not to burn out through arcing. Contact points are usually made of copper or silver since these metals are excellent conductors of electricity and produce a minimum of arcing.

For heavy current loads, mercury switches are frequently used. Here, contact is made by a drop of mercury enclosed in a glass tube which, when level, connects both terminals. Tilting the tube lets the mercury roll away from the wires and thus breaks the connection. Due to the glass construction this type of switch should not be used where it might be subjected to shock.

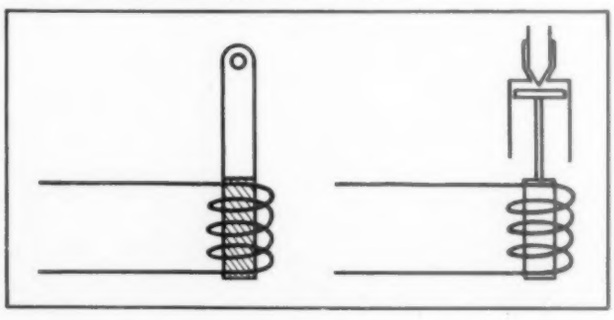
Switches may be manually, mechanically or electrically operated. The manually operated types include push button stations which may contain as many as 10 different switches, as toggle switches (similar to the type used in household applications) and foot operated switches for floor mounting. Mechanical switches are mainly represented by limit switches. Some designs of limit switches will make or break contact with their plunger in the same position within .0005 inches and are therefore used extensively for accurately opening and closing electric circuits. Electrically operated switches are more frequently known as relays or magnetic contactors and will be discussed later.

A solenoid is made up of a coil or wire through which electric current flows. The passage of electricity produces a magnetic field at the center of the coil which will attract steel and iron similarly to a permanent magnet. If we therefore place an iron bar close to a coil of wire, as shown in Fig. 1 (a), and pass current through the wire, the resultant magnetic force will pull the iron bar into the position shown in Fig. 1 (b). The resulting movement can be used for a variety of mechanical applications.

It is customary to mount solenoids in a vertical position so that gravity will return the iron bar (known as the plunger) to the starting position. Sometimes a spring is used to accomplish the same purpose, as when it is necessary to mount the solenoid horizontally or when the force of gravity is not considered sufficient for return stroke. See Fig. 1 (c).

If the upper part of the plunger is made of nonmagnetic material—as shown in Fig. 2—the movement of the armature will cause the nonmagnetic part to move away from

FIG. 2, left—Push type solenoid. *FIG. 3,* right—Solenoid with dash-pot. Needle valve determines speed of air escape.



the coil, resulting in a pushing action instead of the pull exerted by the pull types shown in Fig. 1.

There are certain limitations to the use of solenoids for push or pull applications. The further away the plunger is from the coil, the less the pull, and for a reasonable amount of pull the stroke should be kept short. It is important to prevent the plunger from coming to a stop against the coil at full speed as the mechanical construction of plunger and coil will not stand the impact. This can be avoided by either letting the member moved by the solenoid come up against a solid stop, or by restraining the speed of travel of the plunger by means of a dash pot as shown in Fig. 3.

The amount of power that can be delivered by a solenoid depends on its size. The range covered by a representative manufacturer of solenoids varies from a type exerting .9 lbs. pull at $\frac{3}{4}$" stroke, and weighing 2 lbs., to a model capable of exerting 97 lbs. at 3" stroke and weighing 90 lbs. The former model is dimensioned $2\frac{5}{8}$" x $2\frac{1}{8}$" x $1\frac{3}{8}$" and the latter 10" x $8\frac{1}{4}$" x $6\frac{1}{2}$".

If a fixed soft iron core is substituted for the movable plunger, and current is passed through the coil, the core will act like a magnet and we have an electro magnet. These are used in relays, which are discussed below, and for numerous other applications ranging from detection of slugs in coin operated machines to lifting tons of steel and iron.

As the term "relay" implies, this device relays electrical current. The most common design consists of an electromagnet A (Fig. 4) which, upon passage of current, will attract armature B against spring tension and thus close the contact points C and D permitting current to flow from C to D. Alternately the spring and armature could be attached to contact D in which case application of current to A would cause the contacts to separate. We can therefore open and close circuits by applying current to the coil of a relay.

If a relay is wired into the circuit (as shown in Fig 5), where A is a normally open switch, and D a normally closed switch, it can be used to close a circuit although a manual or mechanical switch is only closed momentarily. It operates as follows: When switch A is closed relay coil C closes relay contacts B. After switch A is opened current continues to flow through the closed contacts B and wire E to the coil holding the contacts closed until switch D is momentarily opened, demagnetising the coil and thus opening the contacts and the circuit.

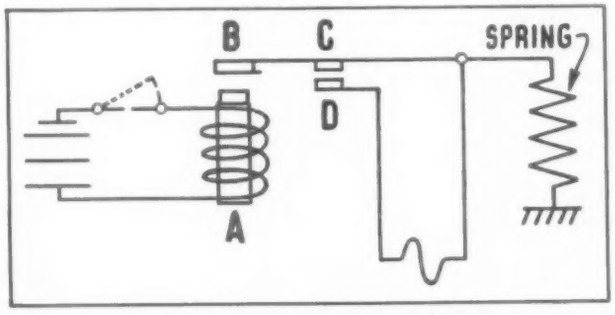
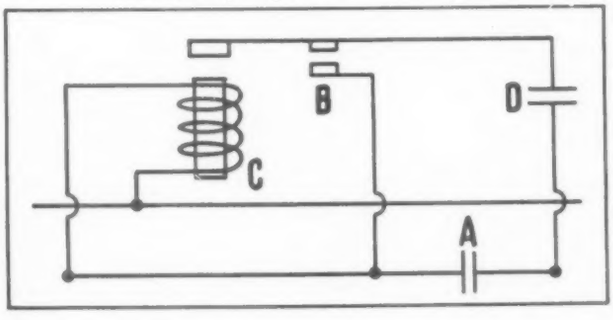


FIG. 4. Electromagnet and relay combination.

FIG. 5. Relay diagram for automatic cycle.



This type of circuit is frequently used on automatic machines and tools where the operator is merely required to briefly press a switch to start the machine cycle. A relay, wired as described, then keeps the circuit closed until the machine completes its cycle and, by some mechanical or electrical means, opens the circuit and brings the cycle to an end.

Commercial relay assemblies are available that will perform the same operation and are known as mechanical latch-in relays. They are provided with two coils. Applying current briefly to one coil allows a latch to drop and hold the contacts closed. Applying current to the other coil raises the latch and opens the contacts.

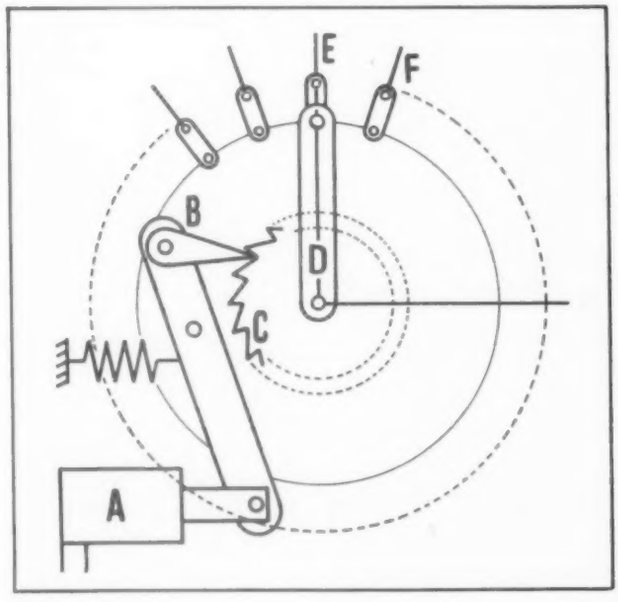
Special relays can be used to produce a time delay between the application of current to the coil and the closing of the relay contacts. Alternately, a time delay may be produced between the breaking of the coil current and the opening of the contacts. When direct current is used and a delay of not more than about .1 seconds is required, a copper slug is attached to the relay which electrically produces the required delay. This is only effective on direct current and cannot be used on alternating current.

On alternating current an inertia time delay relay will produce a similar delay of about .1 seconds but is somewhat larger and more expensive than the copper slug D.C. type. If a longer delay, up to about two minutes, is required, a thermal time delay relay may be used. This embodies a thermal element which is heated by the passage of current and is distorted through the heat developed. After reaching a given temperature, the thermal element closes the contacts.

Obviously, this type cannot be used on rapidly repeating operations, since the relay must be given time, about two minutes, to return to room temperature. Some designs are available, however, that can be used for immediate recycling. These employ the combined heating and cooling of the thermal element before the final switching action occurs. Thus, the element is cool at the end of the cycle and ready to start again.

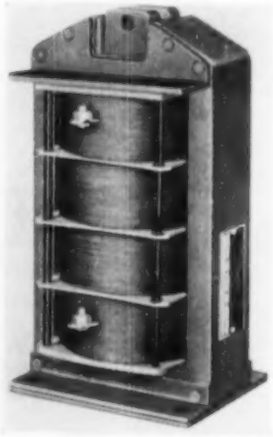
For very accurate time control, motor driven delay relays are available. These are made of small electric motors which

FIG. 6. Typical motor driven stepping relay.



drive one or several cams. When current is applied the motor starts revolving and, after a given number of revolutions, the cam closes the contacts. The position of the cam may be adjusted, so that a closely regulated time delay is available. With more than one cam a number of separate circuits may be controlled.

If a number of circuits are to be brought into operation consecutively, stepping relays are frequently used. The principle of construction is shown in Fig. 6. When current is applied to solenoid A the movement of its plunger with its attached pawl B moves ratchet C one space. This moves contact arm D to fixed contact E and thus operates the circuit connected to E. A spring returns the plunger to its starting position on deenergizing the solenoid. On the next application of current, the arm moves to contact F and thus brings its circuit into operation. A different type of stepping relay may be obtained that will automatically advance the arm from contact to contact until the solenoid is deenergized.

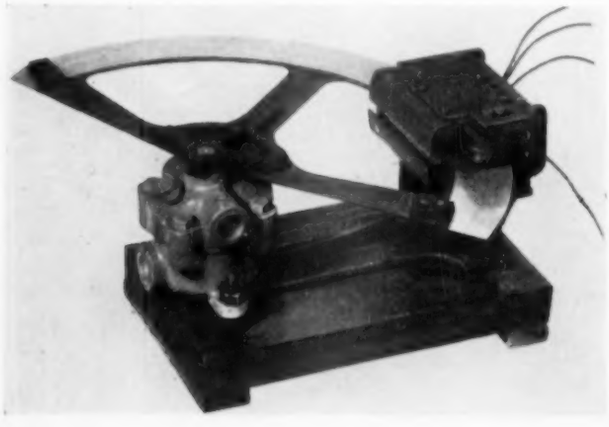


Long stroke pull type solenoid, AL-800 series.

While the writer has endeavored to describe the principles of operation of the various elements that make up control circuits on machines and tools, no attempt has been made to show sample circuits at this time. If the elements are understood the designer will not find it too difficult to select the correct group of units to produce the required machine cycle. In another article, complete circuits and typical wiring diagrams will be discussed which will show the application of the various units.

For those readers who wish to use electrical devices of the type described, but are not familiar with the manufacturers, a list of manufacturers is attached. While the list is necessarily incomplete it will enable the reader to procure the desired equipment.

Below, AWX-218 Trombetta Semotor. Somewhat similar in principle to the Reciprocator (straight line action), these are used for such applications as controlling shut-off valves. Any required number of turns may be obtained, a limit switch on the unit operated limiting the action of the Semotor.



Manufacturers

(a) Push Button Switches
- General Electric Co., Schenectady, N. Y.
- Allen Bradley Co., Milwaukee, Wis.
- Westinghouse Electric Co., Pittsburgh, Pa.
- Square D Co., Milwaukee, Wis.

(b) Limit Switches
- General Electric Co., Schenectady, N. Y.
- Micro Switch Co., Freeport, Ill.
- Square D Co., Milwaukee, Wis.
- Westinghouse Electric Co., Pittsburgh, Pa.

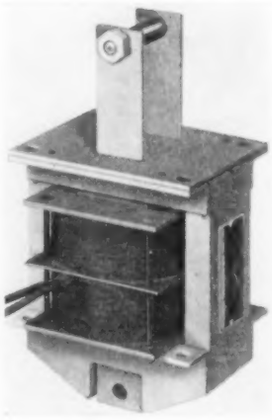
(c) Solenoids
- General Electric Co., Schenectady, N. Y.
- Allen Bradley Co., Milwaukee, Wis.
- Guardian Electric Co., Chicago, Ill.
- Automatic Electric Co., Chicago, Ill.
- Trombetta Solenoid Co., Milwaukee, Wis.

(d) Electro Magnats
- Cutler Hammer Co., Milwaukee, Wis.
- Ohio Electric Manufacturing Co., Cleveland, Ohio

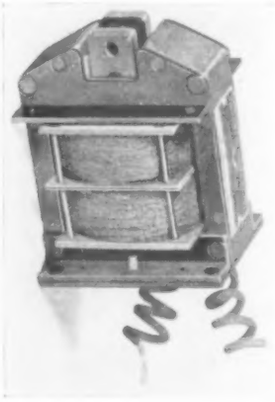
(e) Relays
- General Electric Co., Schenectady, N. Y.
- Allen Bradley Co., Milwaukee, Wis.
- Westinghouse Electric Co., Pittsburgh, Pa.
- Struthers-Dunn Co., Philadelphia, Pa.

(f) Time Delay, Latch-in Stepping, and Special Relays
- Struthers-Dunn Co., Philadelphia, Pa.
- Automatic Electric Co., Chicago, Ill.
- Guardian Electric Co., Chicago, Ill.

The illustrations shown on this page are by courtesy of Trombetta Solenoid Co., Milwaukee, Wis.

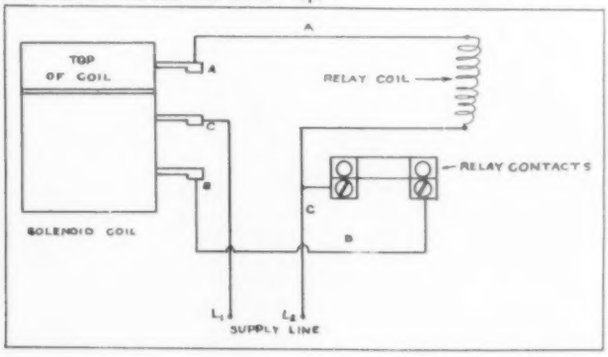


Push-pull solenoid, F-300 series.



Pull type solenoid, F-300 series.

Typical circuit for relay-solenoid installation. Note that top of all D.C. solenoids are marked with word "Top."



By John R. Parks

Designing for Mechanical Press Forging

A New Technique in Hot Forming Metals That Is Applicable to Any Metal That Can Be Forged by Hammering

The forging press is a comparatively recent addition to the family of machines used to hot work metal. While tried experimentally for several decades, it was just thirteen years ago that one of the leading forging machine manufacturers produced their first press designed specifically for forging. Consequently, the technique of handling this type of equipment is so new that little or no recorded material on it can be found.

The past four years of world war gave the technique a great impetus and a vastly increased field, and many companies, large and small, that formerly adhered to hammer forging have come to realize that the mechanical forging press offers many economies over the older methods.

John R. Parks **is a graduate of Case School of Applied Science, and gained practical designing and engineering experience with the Weatherhead Co., Cleveland, the Reynolds Metals Co., Louisville, and the D. L. Auld Co., Columbus, Ohio. At present, he is connected in an engineering capacity with the Columbus Die, Tool and Machine Co. He is a member of the A.S.T.E. and a registered mechanical engineer.**

Such is the case with a machine that is compact in relation to delivered power; that is a self-contained unit with low maintenance cost and which can be operated at a high production rate by a comparatively unskilled operator. This last point is important, considering that a hammer-man is a skilled artisan who is trained over a long period of time. Experience alone can teach him how to get the most out of his machine, dies and material.

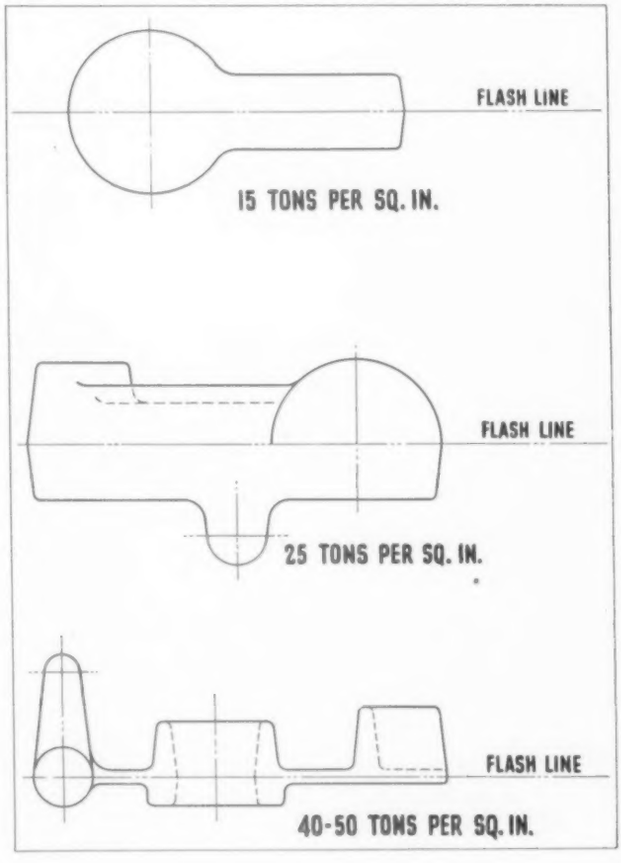
Quite the contrary is true of the mechanical forging press. The operator needs only to adjust himself to a production rhythm and to learn a few principles of operation that will prevent damage to the machine and dies and reduce maintenance time. This, by itself, is a major factor in the economy of forging press operation since, by far, the large part of the success of the method lies in the skill of the men who plan production and who supervise the sample and production runs.

The foregoing introduction has not referred to the type of metal the technique is applied to. The technique can be applied to any metal that is forgeable by a hammer. The greatest application has been in the fields of hot forming wrought aluminum and magnesium alloys and copper alloys. The method has also been applied to the ferrous alloys, but the difficulties in die maintenance have proved great. This does not indicate that there has not been a marked success in production of shapes like gear blanks and other shapes that, by themselves or in a group, can be forged without an excessive movement of the metal in the die cavity or out into the gutter. However, the following paragraphs will be devoted to descriptions of the technique for the production of aluminum and magnesium forgings.

The procedure for producing a part on a hammer has approached a state of exactness that may never be approached by press methods. This is due chiefly to the fact that the bar can be prepared with edging, fullering, bending and blocking operations on a hammer so that, when the finishing cavity is entered, the per cent of flash will not exceed a standard amount. The hammer to be used is generally determined by the size of the face of the die required to accommodate the cavities for the operations necessary to do the job. Such is not the case in the procedure for press forging a part.

To the question, "How large a machine is required to make the part?" the answer is that forging presses are generally rated in tons capacity. While this figure does not have a real significance, it can be a good guide. If the area of the projection into the parting plane of the part is determined, and a fairly accurate estimate can be made of the pressure in terms of tons per square inch necessary to form the part and extrude the excess material into the gutter, the tonnage required to do the job is found as the product of the two preceding quantities.

FIG. 1. Top, detail a; center, detail b; bottom, detail c.



The size of the machine is determined within the following limits: If the tonnage calculated is considerably less than the tonnage rating of the available machine, one may safely proceed. If, however, the tonnage figured is larger than the rated tonnage *plus ten per cent*, and the job is run on that machine, the chances are high that the press may suffer damage or the motor may have its life shortened due to being overloaded in the effort to maintain energy in an excessively slowed down flywheel.

Of course, the catch in the preceding is the "fairly accurate" estimate of the pressure in tons per square inch required to make the part. The writer has determined a set of standards based more on the complexity than on the weight or bulk of the part. These assumed standards are as follows:

1. For parts that are bulbous and simple in shape, and which have a simple trim line, use a pressure of 15 tons per square inch. See Fig. 1 (a).

2. For parts that are not too complex, and which have fairly thick sections, use a pressure of 25 tons per square inch. See Fig. 1 (b).

3. For parts that are complex in shape, with thin sections adjacent to heavy sections, and with channels and I-beam sections running into bosses that are to be pierced out, use a pressure of 40-50 tons per square inch. See Fig. 1 (c).

Fundamentals Plus Experience

These standards are considered by the writer as "fairly accurate" inasmuch as they have served fairly well as guides, and they are passed along to the reader as a matter of interest only. It should be mentioned, at this point, that some manufacturers of forging presses designate their machines by a series number of some sort not associated with a tonnage figure. Generally, however, the forging engineer can enlist the help of the manufacturer of the machine in arriving at a reliable tonnage estimate.

In press forging, determination of material size is somewhat of a trick. Yet it really is not; even a magician has a technique—that is, a few principles fundamental to his field plus experience. In shops where a hammer is used to prepare the slug for the forging press the determination of stock size follows the routine used in hammer shops. In shops like the D. L. Auld Company, only a routine similar to the following may be found useful.

The area of the largest section of the part, as shown on the blueprint, perpendicular to the parting plane and to the direction in which it is estimated that the slug will lie, is the determining factor in developing a stock size. This area is then reduced by "X" per cent, depending on whether the part shows no great variation of cross-sectional area along the main dimension or whether the variation of cross-sectional area is large. In the first case, the "X" per cent may be zero, and in the latter it may be as much as forty per cent.

This reduced area is then converted to the diameter of the round bar or to the cross-section dimensions of a flat bar, depending on the judgment of the estimator as to which would be more economical to start from. In general, press forging is done from a sheared or sawed slug, the length of which is determined by the length of the part to be forged. From this data, the gross weight per thousand pieces may be calculated by the following formula:

$W = 101\ A\ [f\ (L/10)^2 + L + .07]$

Assuming,

A = area of bar in square inches.

L = length of slug in inches.

101 = weight of 1000 cubic inches of aluminum in pounds (use 65 for magnesium).

$(L/10)^2$ = length of the bar end distributed over the length of the slug.

.07 = width of saw cut. This quantity is left out if the bars are sheared.

Example. The slug size required on a given forging was estimated to be 3⅝ in. dia. by by 4¼ long.

In the formula, then:

A = area of a 3⅝" round = 10.40"

f = fractional remainder of 100/4.25 = .53"

L/10 = 4.25/10 = .425" or .43" near enough.

Substituting in the formula:

$W = 101 \times 10.40\ [.53\ (.43)^2 + 4.25 + .07] =$

$= 101 \times 10.40 \times 4.35 = 4569$ lbs. near enough.

This formula was developed on the basis that the average length of the original bars was ten feet. Over a long period of time, with many different bar sizes, the error in this formula was 1% approximately.

The usefulness of the preceding ideas depends on the experience of the estimator in studying the flow of metal in the dies under operating conditions. One basic principle that can be expressed at this point is that the resultant flow of the metal in the dies depends on the restrictions in three mutually perpendicular directions, as, along the axis of the slug; perpendicular to, and parallel to the parting plane.

The restriction along the axis is inherent in forging from a bar, whereas the other two depend on the shape of the cavity in the dies, the sharpness of the edge of the cavity, the presence of gutter and the finish on the die faces. By studying and working with the cavity, a measure of control can be gained over the flow of the metal in the cavity. In general, to make a press forging, two sets of dies are required, namely a blocker and a finisher. A few forgings can be made with the finisher only, however, such forgings are generally simple, bulbous, symmetrical shapes with hardly any variation in section. At the other extreme, there are some forgings that require other roughing dies ahead of the blocker.

Blocker Die Important

The success in producing a complex forging with a press depends on the blocker die. The cavity in the blocker is a rough approximation of the finish die. Minor detail in the finisher, that will not unduly influence metal flow in the blocker, is left out of the blocker cavity. The principal object of the blocker die is to distribute the metal so that the finisher die will have the least possible amount of work to do to fill out the forging without laps and folds. This distribution can be controlled mostly at the edge of the cavity which generally should have a generous radius depending on the depth of the portion of the cavity adjacent to the edge and the amount of excess metal that must escape in the flash.

The writer has taken the following as standard: If the depth of the cavity is ½", the edge of the cavity is ground and polished to a radius of ⅛" to ¼"; however, if the cavity is 1½" deep, the edge is given a radius of ½" to ¾" blended into the cavity. The tendency should be to a larger radius on the edge of the cavity inasmuch as, the larger the radius, the more tendency it will have, not only to allow excess metal to go into the flash, but also direct flow into the deeper portions of the cavity where it is desired.

Fillets and corners of the major detail within the cavity should be the same—or approximately so—as the corresponding fillets and corners in the finisher die. Any considerable departure from this will lead to laps and folds inasmuch as the metal is trapped in the finisher and is afforded slight freedom of movement excepting at the edge of the cavity.

Folds and laps are detrimental to forgings. If they remain in the forging after machining they cause high stress concentrations when the part is in operation, hence, may cause early fatigue failure. This is one of the major reasons that the Army and Navy placed a very tight inspection on forged products. Generally, folds are due to the metal flowing in opposite directions towards a spot in the die cavity. The fibers collapse and fold up tight, in some cases leaving a deep fault in the body of the forging. The elimination of flow of the type just described is not easy and can only be effected by a careful study of the blocker die.

The depths of the blocker cavity can be made somewhat shallower since experience shows that when the depths are the same as in the finisher the metal seldom fills the deeper portions of the cavity. It follows, then, that the lesser depths adjacent should be made somewhat greater than in the finisher so that the finisher die will aid in flowing the metal into the deeper parts of the finish die during the finishing operation. Fig. 2 illustrates this. The finisher cavity is sunk with all the detail required of the finished part.

Great care should be exercised in finishing the edge of the cavity, since it is at that point that the die experiences a high dynamic reaction. The standard, applied by writer with marked success, is $\frac{1}{32}$" radius finished smooth with elimination of all tool marks running parallel—or nearly so—to the edge of the cavity. The land around the edge of the cavity of the finisher die is made never greater than $\frac{1}{8}$". The surface of the finisher cavity should be polished as smooth as is consistent with cost.

A high polish, to remove tool marks in the cavity, not only gives the forging a high quality surface finish, but also adds markedly to the life of the die by reducing fatigue effect. Press dies, in operation, breathe and bend to a surprising degree. By the rigid exercise of care in the finishing dies a die life of 75,000 pieces and over has been noted.

The thinner the flash at the body of the finished forging, the neater the trim line. On a range of parts, as shown in figure 3, covered by presses running from 400 to 1,000 tons capacity a flash thickness of .020" to .030" is maintained on the smaller parts while, on the larger, the thickness is held to .040" to .050".

In the majority of cases the slug is struck once in a blocker die, reheated and struck once in the finisher to make a finished forging to the desired tolerances. Occasionally, two blows in the blocker, with a rough trim in between, are necessary so as not to leave too much excess stock to be extruded into the flash of the finished part. Where the die space permits, the blocker and finisher cavities can be sunk in the same die block with a consequence that the operations can be performed without reheating the blocked slug. Figs.

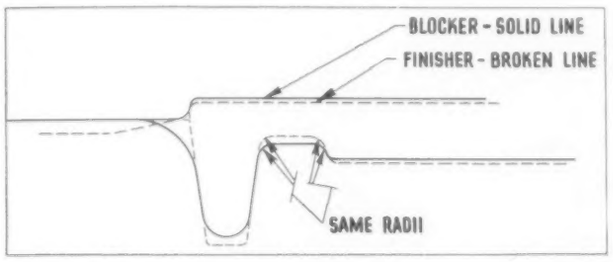


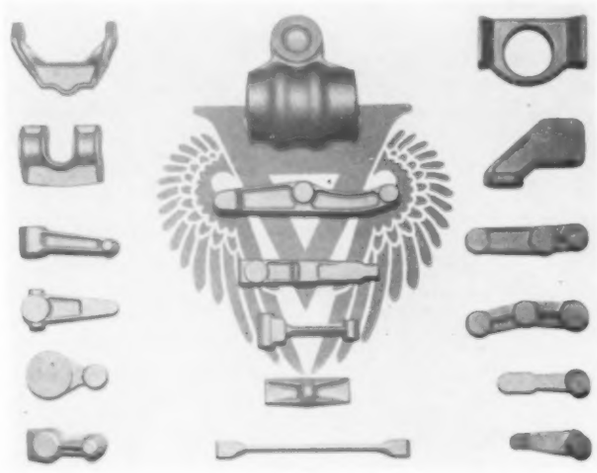
FIG. 2, above.

FIG. 3, right, aircraft structural forgings produced on presses ranging from 400 tons to 1000 tons.

FIG. 4. Fitting forging. Slug size 3.5 inches diameter by 2.3 inches long, 145 aluminum alloy upset. Procedure is block and finish forge. Part was made on a 1000-ton press.

FIG. 5. Tail wheel fitting. Slug size 1.637 inches diameter by 3 inches long 175 aluminum alloy. Procedure—block and finish forge. Part was made on a 500-ton press.

FIG. 6. Bracket-roller hoist forging. Slug size: 3 inches diameter by 2 inches long 145 aluminum alloy. Procedure is block, rough trim and finish forge. Part was made on a 1000-ton press.



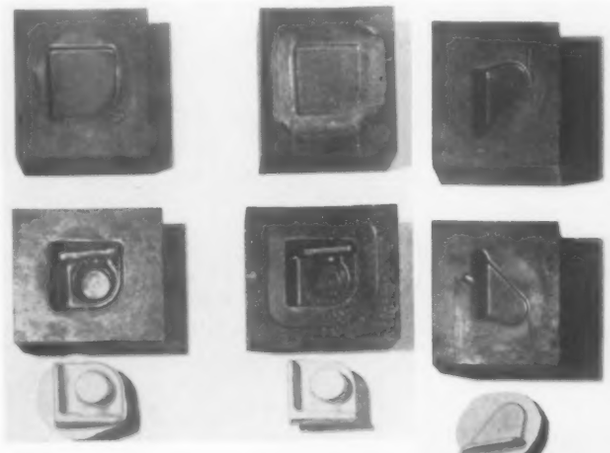
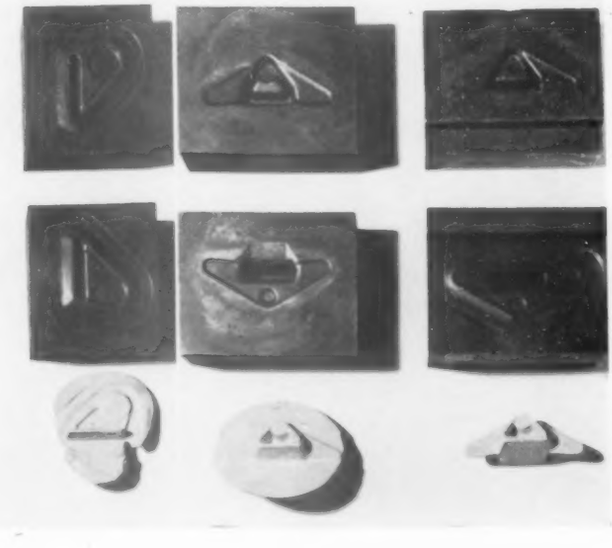


FIG. 4, above; FIG. 5, center; FIG. 6, right. Each takes in a group of four.



4, 5 and 6 show the dies and corresponding pieces as produced on a modern 1,000-ton forging press, shown in Fig. 7. In figures 4 and 5, the finished forging is shown without flash as none could be found with it when photographed; in both cases, however, the flash was less than 5 per cent.

New Structural Metals

So far, this discussion has dealt with the art of press forging, with little reference to the metal with which this art was developed. Just as press forging is the twentieth century art of hot working metal, so aluminum and magnesium are the twentieth century structural metals.

Aluminum and magnesium flow in the dies like a heavy viscous gum. These metals, in moving at their forging temperatures, absorb a larger amount of energy than does steel at its forging temperature. In comparison, steel splashes in the dies of a hammer and must be restrained in some fashion. It has been estimated that, volume for volume, aluminum and magnesium may require at least twice the capacity required for forging steel. Usually, in hammer or press forging steel, the deeper cavity is in the top half of the die whereas, in press forging aluminum and magnesium the deeper cavity is placed in the bottom half. Steel, when pressed or struck, seems to react towards the moving ram while aluminum and magnesium have the opposite tendency.

Aluminum alloy, because of an inherent toughness at forging temperature, kept the engineers looking for the proper die lubricant to help decrease reaction on the dies. In the writer's estimation, the high production of improved quality aluminum forgings was not quite feasible until just after the war began. A new and different die lubricant and method of application, such as developed by the Renite Company, was necessary. When sprayed on the dies—the temperature of which is maintained at a minimum of 250° F.—this non-organic oil base lubricant leaves the die with a dry graphoid surface which greatly improves the flow of the metal in the dies. Applying this lubricant to the die by means of a spray, not only provides an excellent anti-friction surface but also cleans the cavities by blowing out all foreign material. See Fig. 7. The diesel effect occasioned by organic oil vapors being trapped in the die and the resulting smoke, from the use of other types of lubricants, were entirely eliminated. The resulting increase of production and die life were high, to say the least.

FIG. 7. 1000-ton press illustrating application of die lubrication.

Along with all the improvements in die steel, lubricants and forging techniques, there has been a steady improvement in forging press design. The first requirement in design, from the viewpoint of the engineer, is rigidity. Press manufacturers have divided themselves into four main fields of construction aiming at rigidity.

1. Integrally cast steel frame—crown, uprights and base cast in one piece.
2. Integrally cast steel frame cored so that it can be stressed with tie rods.
3. Crown, uprights and base separate but keyed together and stressed with tie rods.
4. Welded construction with and without tie rods.

This is a wide range of construction to select from, and each type of construction has its own peculiar advantage.

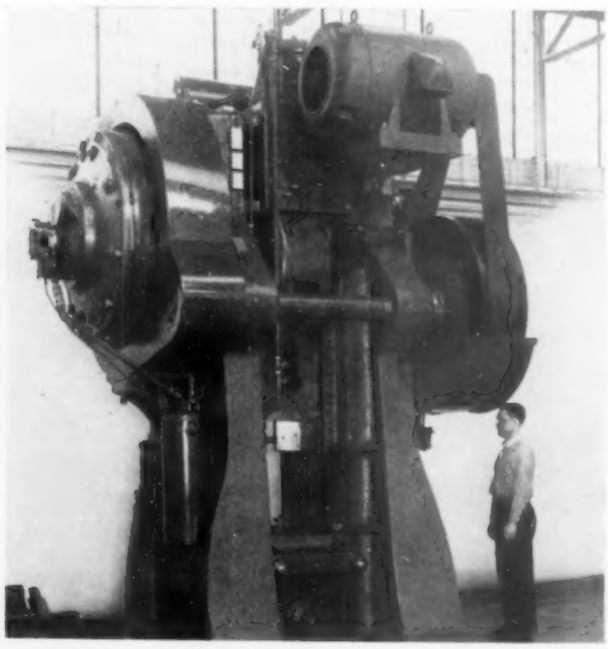
In order to obtain a rigid set up for the sow block for the lower die, some manufacturers offer a set of wedges to be inserted between the sow block and the uprights so that all side thrust on the die is transmitted to the frame. These wedges can also be used to obtain lateral movement for lining up the dies.

The slide has long guide bearing surfaces to reduce tilt and is direct connected to a counter balance cylinder to reduce lashing to a minimum. The pitman bearing is a heavy bronze shell. The reciprocating motion is obtained from a forged, full eccentric crankshaft. The strokes per minute of these are much higher than older presses of the same rating.

Two Types of Press Drive

The drive mechanism falls into two general classes. Some manufacturers prefer to mount the flywheel disc, clutch and brake on the jackshaft, in which case the crankshaft can be double geared, while others put the clutch and brake on opposite ends of the crankshaft and the flywheel on the jackshaft. In this latter case, the manufacturers claim that, with the clutch and the brake on the slowest part of the drive, inertia forces are reduced, resulting in longer life and lower maintenance cost.

FIG. 8. A modern 1000-ton forging press.



The disc clutch and brake are air operated on a control system that, to say the least, is flexible. When the brake disengages the clutch also engages, and vice versa. Generally, the control system includes a selecting device for running the press continuously, for one shot or for inching. This last selection is a boon to the set-up man since, with finger tip control, he can lower the slide as slowly as he pleases and stop it with safety. This device saves much time in set-up and in making die adjustments. For a good illustration of a modern forging press, see Fig. 8.

The forging press, by virtue of its rigidity and being equipped with knockouts, can produce forgings that require an absolute minimum of machining. Forgings can be consistently produced to tolerances as low as plus or minus .005" and draft angles as low as 2°. For this reason, the forging press (after further development of the technique, die steels and other auxiliary equipment) will be in direct competition with hammers in the forging of not only nonferrous materials but also ferrous alloys.

The upper limit of the tonnage rating of mechanical forging press has not been approached. Machines of four thousand tons capacity have been in operation during the war, and this is not the end. From the design engineers' point of view the upper limit taxes imagination. New construction techniques are being developed constantly. The general manager of one of the larger forging press concerns has remarked that only difficulties in transport may determine the upper limit of mechanical forging press tonnage rating.

Being relatively new in the field, the pressed forging has had to fight for recognition. The hammer forging technique is so entrenched that, to mention the word "forging" is psychologically synonomous with "hammering."

However, future development of the art now hinges on the strength of the cooperation between the die steel maker, the furnace producer, the forging alloy metallurgist and the forger in meeting the actual and potential requirements of the ultimate consumer of forgings.

Formula for Design of Cam Clamps — a Correction

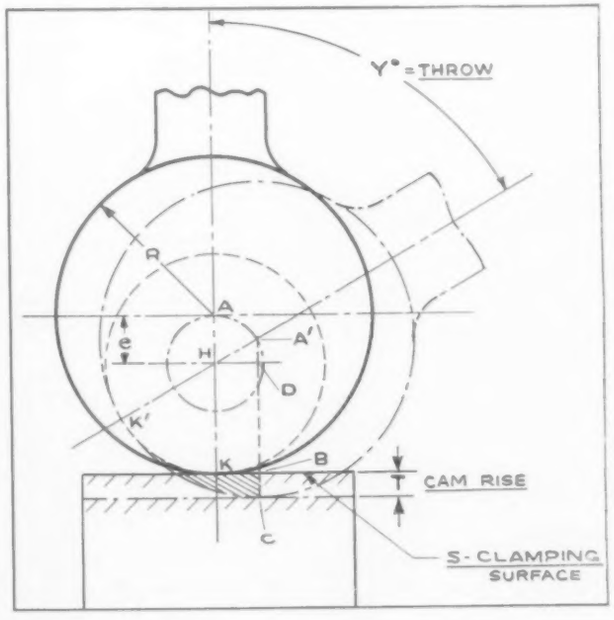
In "Formula for Design of Cam Clamps" (Sept. THE TOOL ENGINEER, page 45) by Alfred R. Goatley, the author describes the action of the cam as follows:

"As the cam is rotated the surface of the cam bound by arc CK' will slide over the clamping face moving it a distance BC = T. If the curved taper strip BKK' C (shown shaded) were laid out, it would appear as a thin wedge . . . in which the hypothenuse is the arc CK', the wedge rise is T and the wedge angle W degrees."

He then advanced the following formula for ascertaining the value of the eccentric "e":

(Then, sin W = T/arc CK' = T/RY where Y is in radians, = 57.3 T/RY where Y is in degrees. Transposing, we get: (1) R = 57.3 T/Y sin W where Y is in degrees. To find the eccentricity e, refer to Fig. 1, where T = BC = A'C — A'B = R — (A'D + DB) = R — (e cos Y + R — e) = e (1-cos Y). Therefore, e = T/1-cos Y) in which:

R = radius of cam; e = eccentricity; T = rise of cam; Y = angle in degrees through which cam rotates to produce rise T; W = wedge angle (7° maximum—use smaller value for tight clamping).



The formula was challenged by H. Guenther, Racine Chapter, who declared the part enclosed in parenthesis in the preceding column in error and suggested the following correction:

Fig. 1 should be redrawn* without shading area BKK' C. Then add line CH and call the angle formed by lines CH and CA' the wedge angle W. . . . I'd like to suggest also to draw a horizontal line through point A',** intersecting the line HA at a point which I will call E.

"It is apparent that AE = T (cam rise) and T = e cos Y, therefore e = T/1-cos Y.

"While this checks with Mr. Goatley's formula (2) I believe that my approach is simpler. Also, this formula should be developed *before* the formula for R (radius of cam). To find the latter, I suggest:

"CA' = R = CD + DA'; DA' = e cos Y and HD = e sin Y. Therefore: CD = e sin Y/tg W.

By substituting, R = e sin Y/tg W + e cos Y, or,

R = e (cos Y + sin Y/tg W) and, substituting for e:

R = T/1-cos Y (cos Y + sin Y/tg W)"

All correspondence on the matter was referred to Mr. Goatley, who gracefully conceded the correctness of Mr. Guenther's version.

*The original Fig. 1 reproduced at left.

**Continuing line A', between minor and major axes of cam, as designated by e.

High-Speed Induction Element

An eight-pole, induction-disk element, designed by Westinghouse engineers, speeds up directional-element action in relays. The eight poles are arranged on both sides of the disk for maximum contact area to produce torque.

Speed of operation is less than 1/60 second over a range of currents up to 100 amperes during voltage variations from one-half to 115 volts. Saturation of the magnetic circuit at relatively low current is responsible for this. The element can be easily dismantled and reassembled in the field, thus simplifying the maintenance job. By changing coils, it can also be made into other types of relay elements—for example, an instantaneous current or instantaneous voltage type—and it can be directionally controlled without using auxiliary relays.

The Elements of Gearing

No. 7 of a Series

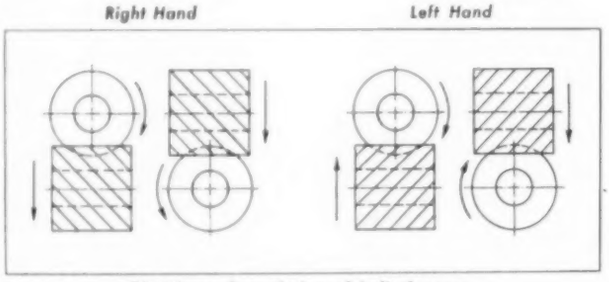
Calculations of Gears – Concluded

Helical Gears

Helical gears are essentially equivalent to a number of very thin spur gears, placed side by side, and offset relatively to one another, so that there is at least one pair of teeth in contact at any point on the path of contact. This uninterrupted engagement of teeth eliminates sudden jumps which are inevitable in spur gears. In helical gears the teeth are cut on an angle with reference to the axis and the teeth curve as helices over the gear face.

For continuous uninterrupted action the *minimum width* w must be Pc/tan a, where Pc is the *circular pitch* and a is the *helix angle*.

23° and 30° are the commonly used helix angles, although

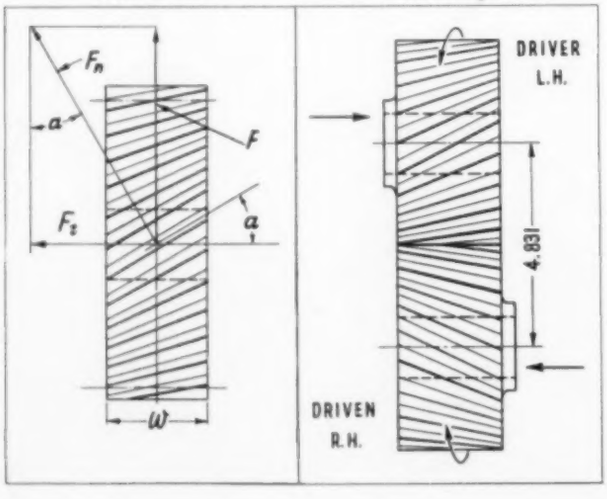


Directions of revolution of helical gears.

for high speeds 45° may be used. The American Gear Manufacturers' Association recommends a minimum face width 15% greater than Pc/tan a. In practice, widths of at least three times the circular pitch are preferred.

End Thrust. If friction is neglected the pressure between a pair of teeth is normal to the tooth surfaces at the point of contact, as shown by Fn in Fig. 5. This normal force Fn can be resolved into two components, Ft, along the axis and F—the tangential force *at the pitch line*. Ft is called the *end thrust*.

FIG. 5, left. FIG. 6, right.



Ft = Fn sin a, or Ft = F tan a.

One of the first steps in helical gear design is to determine the direction of the thrust which depends on the direction of helix, the direction of rotation, and the relative positions of driver and driven gear.

Speed ratios of the shafts determine the number of teeth in each gear.

Helical gears can have

1. axes parallel;
2. axes at right angles;
3. axes—any angle.

Axes parallel. The angle of teeth with axes in both gears must be equal and the helices run in opposite directions. Such gears are comparatively noiseless running at high speed. To avoid excessive *end thrust* a small angle is chosen. By combining two pairs of gears with right- and left-hand helices—end thrust is entirely eliminated. Gears of this type are known as *herringbone* gears.

From Fig. 7 (Page 45).

Pc = circular (circumferential) pitch

Pn = normal circular pitch

cos a = Pn/Pc

The angle of helix depends upon the conditions of the design and the relative position of the shafts. For parallel shafts a designer should not go above 20°. Otherwise, the end thrust might be too excessive.

The conditions of the design determine whether center distance must be approximate or exact.

Center Angle: The center angle of a pair of helical gears is the angle made by the two center lines or axes of the gears.

Helix Angle: The helix angle is the angle which the direction of the tooth makes with the axis of the gear.

The diameter of a helical gear increases with its angle.

Forty-five degrees (45°) is accepted as the most efficient *driving angle*.

The *center distance* will increase with the angle of the driver. This increase is more rapid when reducing the speed of a follower. This refers to the case when the axes are parallel.

Normal diametral pitch: The normal diametral pitch is the diametral pitch of the cutter used for cutting the teeth in helical gears. The normal diametral pitch varies with the angle of the helix.

It is usual shop practice to make *normal circular pitch* such as to use the available tools, and then the angle is chosen to suit.

Example 6: Normal diametral pitch of two helical gears is 6; shafts are parallel; center distance is approximate; helix

angle is 15 degrees; and the hand of helix on driver or driven gear depends on the direction in which thrust is to be received and gear rotated. Calculate the necessary dimensions. See Fig. 6 (Page 44):

D = pitch diameter
O = outside diameter
C = center distance
L = lead of helix
pn = normal diametral pitch
N = number of teeth
D = N/pn cos a = 28/6 cos 15° = 4.831 inches
O = 4.831 + 2/6 = 5.164 inches
2C + 2N sec 15°/pn = 56 × 1.0353/6 = 9.6624 inches
C = 4.831 inches
Check: C = D = 4.831 inches
Cutter to use, N/cos² a sin a = 112 teeth
From Brown & Sharpe table—cutter No. 2 to be used.
L = π D cot a = 3.1416 × 4.831 × 3.7320
= 15.177 inches.

Example 7: Normal diametral pitch of two helical gears is 6; shafts are parallel; center distance is exactly 5 inches; number of teeth 28, in both gears.

Calculate the necessary dimensions.
Cos a = N/pn D = 28/6 × 5 = 9.333
<a = 21° 2′
O = D + 2/6 = 5.333 inches
Cutter to use, N/cos² a sin a = 28/cos² 21° 2′ sin 21° 2′ =
= 89 +, or
Cutter No. 2
L = π D cot a = 3.1416 × 5 × 2.6006 = 40.85 inches

Example 8: Assumed: Center distance C = 20 inches; helix angle a = 20 degrees; number of teeth in small gear n = 20; number of teeth in large gear N = 50; normal diametral pitch pn = 4. Calculate necessary dimensions.

Pitch dia. of large gear D = N/pn cos a = 50/4 cos 20°
= 13.302 inches
Pitch dia. of small gear d = n/pn cos a = 20/4 cos 20°
= 5.321 inches
O = D + 2/pn = 13.302 + 2/4 = 13.802 inches
o = d + 2/pn = 5.321 + 2/4 = 5.821 inches
C = 1/2 (D + d) = 1/2 (13.302 + 5.321) = 9.312 inches
L = π D cot a = 3.1416 × 13.302 × 2.7475 = 114.827 inches
l = π d cot a = 3.1416 × 5.321 × 2.7475 = 45.927 inches
Cutters to use, N/cos² 20° sin 20° for large gear and n/cos² 20° sin 20° for small gear.

Example 9: Gears have shafts at right angles; same direction of helix and the sum of the helix angles equals 90 degrees; exact center distance C = 10 inches; pn = 8; ratio r = 3; a^1 = approximate helix angle of large gear—45 degrees; N = number of teeth in large gear and n = number of teeth in pinion; a = exact helix angle of large gear; b = exact helix angle of small gear = 90° — <a. Calculate necessary dimensions. See Fig. 8.

n = 2C pn sin a^1/(1 + r tan a^1) =
= 2 × 10 × 8 × .70711/(1 + 3) = 28 teeth
N = 3 × 28 = 84 teeth

Now we can calculate an exact helix angle of large gear by trial:

r sec a − cosec a = 2Cpn/n, or r/cos a + 1/sin a =
= 2 × 10 × 8/28 = 5.714

It is found by trial that angle 46° 6′ will satisfy the above equation.

Cos 46° 6′ = .69340
Sin 46° 6′ = .72055
3/.69340 + 1/.72055 = 5.715
The difference is 0.001.
∴ <a = 46° 6′ and
<b = 90°—46° 6′ = 43° 54′
Since helix angles are practically 45°, use formula N/cos³ a to find proper cutter.
N/cos³ a = 84/cos³ 46° 6′ = 84/.6934³ = 84/.3332 =
= 252 + teeth
Use cutter No. 1
n/cos³ b = 28/cos³ 43° 54′ = 28/.374 = 75 + teeth
Use cutter No. 2.

The following data is required for helical gear hobbing:

Pitch diameters of pinion and gear	
Number of teeth	Diametral pitch (cutter)
Pressure angle—normal	Helix angle
Chordal addendum	Tooth depth
Lead of helix	

Example 10: Helical gear has 111 teeth; pinion—14 teeth; diametral pitch for *stub* tooth is 7; helix angle—20; pinion—R.H.; gear—L.H. Calculate center distance and the required data for hobbing this set of gears.

D = N/pn cos 20° = 111/7 × .93969 = 16.8747 inches
d = n/pn cos 20° = 14/7 × .93969 = 2.1283 inches
C = 1/2 (D + d) = 1/2 (16.8747 + 2.1283) =
= 9.5015 inches

Since this is a *stub* tooth, refer to February issue, page 47, for formulas to calculate *chordal addendum*, *chordal tooth thickness* (*normal*), and *whole depth*.

Chordal addendum = .800/7 = .114 inches
Whole tooth depth = 1.800/7 = .2571 inches
Chordal tooth thickness—normal = (D/2N) cos 20° =
= (3.1416 × 16.8747/2 × 111) .93969 = .2241
Lead of helix L = π D cot 20° = 3.1416 × 16.8747 ×
× 2.7475 = 145.654 inches
l = π d cot a = 3.1416 × 2.1283 × 2.7475 = 18.3670 inches.

Gear to be cut .009 inch deeper for .006 inch *backlash*, and no allowance for backlash to be made on *pinion*.

FIG. 8, left.

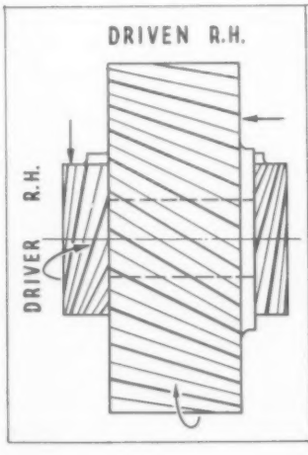


FIG. 7, right.

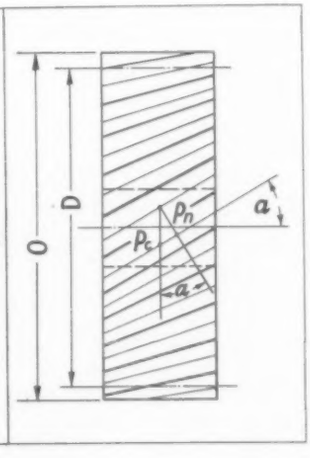
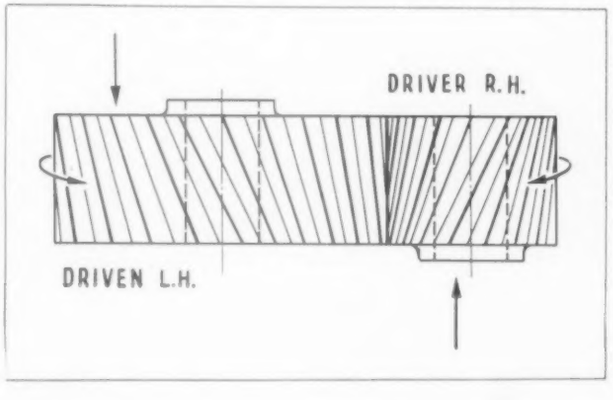


FIG. 9



GADGETS

Ingenious Devices and Ideas to Help the Tool Engineer in His Daily Work

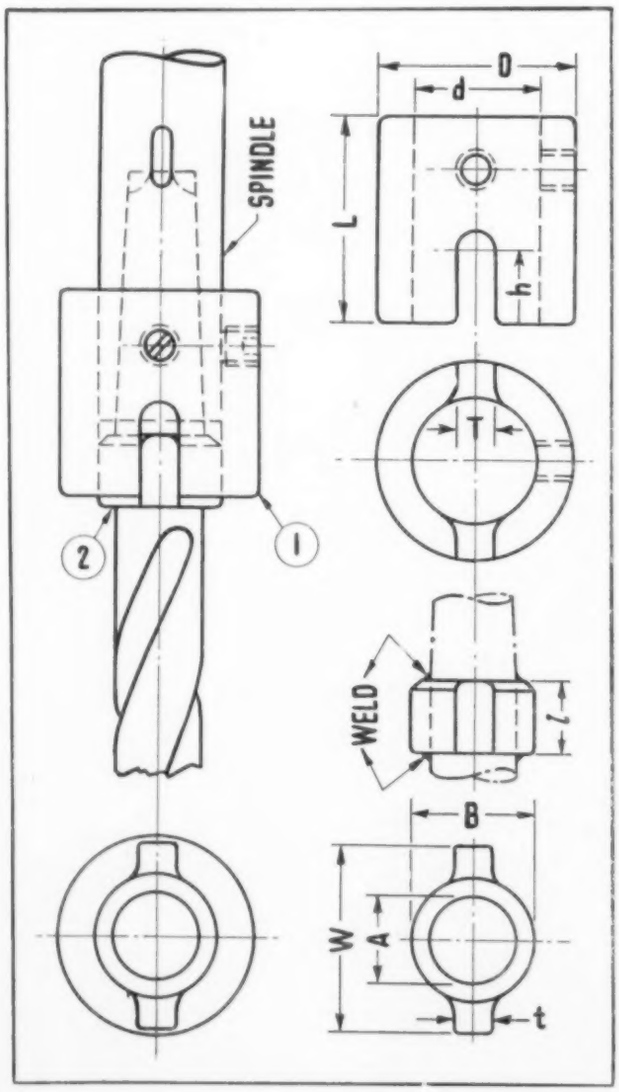
Heavy Duty Driver

A BAD FEATURE of taper shank drives, for drills and other cutting tools used in drill presses, is that the tangs twist off under heavy loads. With the simple "gadget" shown, all strain is removed from the tank, which then only serves for purpose of knockout.

A sleeve—Det. 1—is made to fit the O.D. of the drill spindle. The I.D. (designated as d) is made slip fit, and the O.D. (D) should be roughly twice the I.D. Two adequate set screws, at right angles, should be provided, although a key would be desirable as added security against turning. A slot (T) is provided, with width in proportion to the diameter of the driven tools. Depth (h) can be about twice the width. Length (L) should be twice the I.D. (d) plus at least ¾".

A small sleeve (Det. 2) fits the tool just below the taper, the O.D. of which (B) should be a slip fit in Det. 1. The driving lugs (t) should also be a slip fit in the slot T. The length (L) should be slightly less than h in Det. 1, and the I.D. (A) is preferably a press fit on the shank of the tool, just below the major diameter of the taper shank. After assembly, it should be tack welded to the tool, as shown in the drawing. Once applied, it will be found that tools of considerably larger diameter than rated capacity of the taper shank can be used, and without the "spring" or tendency to loosen that is an inherent fault of the conventional tang driven tool.

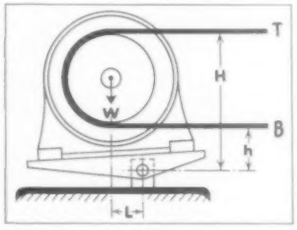
C. J. Mogford, Detroit, Mich.



Again—The Hinged Motor

"The Hinged Motor—it always does the Right Thing," by W. F. Schaphorst in the July issue, THE TOOL ENGINEER, aroused wide interest and a number of readers, including Richard M. Wagner of Providence, R. I., H. Guenther of Racine, and Laurence L. Cruse of Des Plaines, Ill., submitted varying versions regarding the "how" of the thing.

Correspondence, over a period of time, was referred to Mr. Schaphorst, who stated that he had submitted the item to the principal manufacturer of the *rocking base*, and that it had been approved as outlined. Finally, the matter was referred to Prof. E. S. Ault of the School of Mechanical and Aeronautical Engineering, Purdue University, whose findings follow, in gist:



"The . . . discussion on the pivoted motor drive is covered extensively in a paper, "The Pivoted Motor Drive," by Robt. E. Tatnall in *Mechanical Engineering*, May 1935, reprinted in *Machine Design*, May 1935, and discussed further in *Machine Design*, Oct. 1935.

"Schaphorst is dealing with the equilibrium of the unit of *stator and rotor*, and his statement relative to summation moments acting on the whole unit is correct. The effect of torque reaction on the stator cancels out except for the condition of acceleration of the rotor . . . it is too involved to discuss briefly. Some of the expressions by Mr. Schaphorst are . . . indefinite, probably because of his desire to achieve extreme simplicity.

"The . . . commentator(s) seems to misinterpret or misquote Schaphorst, because I do not find in the original article that 'the author states that the idle position of the motor is determined by the upper belt tension times its lever arm as opposed to the lower belt tension times its lever arm'."

Mr. Schaphorst, in turn, sums it all up as follows:

". . . I have read the criticisms several times and find nothing wrong . . . likewise, I still don't find anything wrong with my own analysis . . . it could be possible that an error slipped through."

And that, unless something new and novel turns up, closes the discussion on the Hinged Motor.

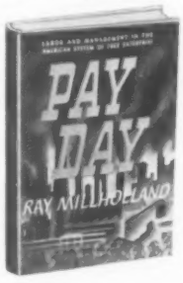
Ed.

GOOD READING

A Guide to Significant Books and Articles of Interest in the Trade Press

PAY DAY by Ray Millholland (William Morrow and Company, Inc., $2.50) is the first really popular analysis of labor relations to be published and offers a six point program which, in the author's opinion, will end strikes. Among the things discussed are: the pride of craftsmanship; the law of the ceiling; man and the machine; piece work or straight time; closed or open shop; job security; disputes and grievances; fact finding and women in industry.

Ray Millholland, who is well known for his "Blue Chip Haggerty" stories—and others in similar vain—"knows his stuff." He has been an apprenticed machinist, foreman, master mechanic, tool designer and factory owner and, during the war served as labor relations expert with the WPB.



Available in most book stores, the book is particularly timely and of vital interest to both management and workers as it points out what both sides want and, by designating shibboleths of both camps, points out a logical road to industrial peace and full production.

HYDROPRESS BLANKS BOILER PLATE, by Walter I. Camp, in March 14 *American Machinist,* describes a method of punching steel plates, up to 7/8 inch thick, with a 3,500 ton self-contained press and 1,000 ton cushion assembled in the bed. With properly designed dies, the finished blank comes from the die as flat as the plate from which it was punched. No additional straightening is necessary before welding plates into the assembly and accuracy of dimensions is insured by proper die design.

In the same issue, **BASIC RELATIONSHIP OF HYPOID GEARS,** a third installment, Ernest Wildhaber points out that hypoid gears can be generated with a rotating face mill type cutter describing a tooth of basic members which are helical segments instead of crown gears.

DEEP DRAWING OF MAGNESIUM, by Ralph G. Gillepsie in March *Machinery,* shows illustrations of products and die drawings, and points out the adaptability of magnesium alloys for almost every type of portable equipment, such as adding machines, typewriters, sewing machines, lawn mowers and a large variety of household appliances.

METALLOGRAPHIC EXAMINATION DISCLOSES CAUSES OF MACHINING DIFFICULTIES, by N. R. Cusworth, J. W. Caum and S. S. Kingsbury, in February *Materials and Methods,* discusses the causes of rapid dulling of tools, development of cracks in materials and unsatisfactory finish.

U. S. Rubber Co., Rockefeller Center, N. Y. 20, has published a series of four radio talks delivered by professors H. A. Bethe, H. C. Urey, James Franck and J. R. Oppenheimer. The title of this timely, interesting brochure is **"THE ATOMIC AGE."**

STUDIES IN ARC WELDING, edited by A. F. Davis and Ed C. Powers and published by *The James F. Lincoln Arc Welding Foundation,* Cleveland, Ohio, is the work of 113 contributors—all men of experience—including executives, engineers and designers. The book contains valuable information on a wide variety of applications representing every type of industry. 1281 pages, clothbound, $1.50 postpaid in the U. S., $2.00 elsewhere.

How to "Rebuild Skilled Labor Force for Peace," in *Modern Industry,* reviews factors which have prevented expansion of apprentice training and points out that barriers to this expansion have now been broken and that the "chief wedge toward changing the situation is the return of servicemen." The author stresses the assistance available by Apprentice-Training Service and State agencies, and concludes with a list of ten guiding points for any successful apprenticeship program. Reprints are available from the Apprentice-Training Service, U. S. Department of Labor, 1778 Pennsylvania Avenue, N.W., Washington 25, D. C.

Optical Engineer By G-E

General Electric engineers, with the aid of a newly-developed instrument—the Rotascope—now are able to make any rotating object appear motionless before their eyes. The blades of electric fans or airplane propellers will appear to stand still, even though whirling at full speed, when the "optical engineer" is focused upon them.

Developed for the study of airplane propellers under actual operating conditions, the Rotascope is the first instrument of its kind which allows the continuous viewing of a rotating object at any point on the perimeter or path of travel.

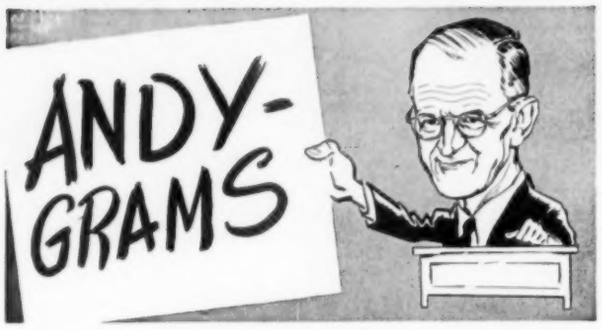
The new device solves the scientific problem of an optical system capable of untwisting the light of rotating equipment before it is recorded by the human eye. It eliminates the rotary component of motion, but shows any flutter or vibration of the moving part, thereby making it possible for scientists and engineers to make a thorough study of the rotating parts of machinery.

Speeds up to 2,000 revolutions per minute can be studied with the Rotascope. The "optical engineer" also may be used in industry for the study of angular motions, particularly those of low angular velocities.

New Die Steel By Heppenstall

Heppenstall Co., Pittsburgh, presents their new prehardened die steel, *Silver Hardten,* which is now available for die casters of zinc and zinc-lead alloys. Produced in the form of die blocks, as well as die block bars and inserts, the steel can be furnished at any desired hardness. However, the usual hardness required for zinc and zinc-lead alloys is between 286 and 321 Brinnell hardness.

This steel offers the advantage of free machining steel; breakage or warpage has been eliminated; and the final grinding operation, usually performed when dies are hardened after the impression is machined, is also eliminated.



SEVERAL OF THE BOYS, including a past Director, cornered me a while back and asked what I thought about all these strikes that are currently slowing up the "back to normal" program. Well now, I'm not supposed to have opinions (at least, I so infer), which is rather fortunate a/c, to form opinions, one must necessarily think. And thinking, as you may have heard, is the most painful ordeal to which we humans may be subjected. So, I don't think. When writing, my fingers "wander idly over the noisy keys," and if sense comes out of the opus(?) I'm as surprised as the most critical of my readers. Oh, the bliss of ignorance!

So, not having any opinions, I'm not obliged to commit myself. And, it's as well, considering that the only times I've ever been involved in strikes I've been in the middle—the fated spot for tool engineers. But, if I had an opinion, I would question anything being normal in an age of abrupt transition. Disbelief in normalcy—or tradition—prompted the forming of the A.S.T.E., as a result of which the tool engineers have just about revolutionized industry. Nossirs, there's no normalcy in a dynamic society—that is, nothing is normal except change.

Mention of my "vacation," in March issue, evoked expressions of sympathy from a number of friends in the A.S.T.E. circle. Now, sympathy is the last thing I want, and the only reason I mentioned a passing illness was to show cause why I can't keep up with demand on my time. For one thing, I'm 'way behind on correspondence and, for the time being, have had to defer acknowledging contributions—i.e., of material sent in for publication. I'll get around to it, bye and bye.

As a matter of fact, I've always come out the better for being laid up for repairs. Hospitalized when a tad, in Sweden, I was bedded down between an architect and an artist. The twain taught me the rudiments of instrument and freehand drawing, and my nurse—Betty Lauren by name—coached me in the three Rs. Between them, they had a considerable hand in shaping my destiny. And, laid up on various occasions since then, I've generally managed to come out the wiser—and, needless to say, the healthier.

Bent an elbow with the Detroiters at their March meeting, the occasion being the installation of new Chapter officers, headed by W. B. (Slim) McClellan, now Ch'man. I've known Slim since joining the Society back in '33 or thereabouts, and like myself, he's been in harness in some capacity or other ever since. What I like about him is his fine sportsmanship, a trait that makes him a prime favorite wherever he goes. Incidentally, he is a member of the Detroit Sportsmens Congress, and I'd say that he's as much a credit to the Nimrods as he is to the A.S.T.E.

Slim, by the way, has proposed that we revive the Hounds, interned for the duration, at the Cleveland meeting. Well, spring's here, the sap's running and the Hounds are baying, rarin' to go! If I remember right, Gardner Young is still keeper of the bone pile, and I see Arnold Hague and J. W. Hansen occasionally, so maybe we can rally the pack. Anyway, here's to bigger and better fire hydrants!

Letters and personal comments keep coming in, the most complimenting us on the quality and diversity of the articles appearing in THE TOOL ENGINEER. Well, if variety is the spice of life, there should be seasoning to suit all tastes. One thing, decided on when taking over the publication, was to confine all articles to the editorial pages, without overrunning into the advertising. That is, no "continued on page umpty-nine," and so on, all of which is just another headache to busy readers.

This departure from conventional magazine make-up has not only enhanced interest in our editorial contents but, to considerable extent, the value of TOOL ENGINEER advertising as well. To fill out pages, we insert "shorts" which are carefully selected for their interest—too carefully selected, I'm beginning to think.

For example, a filler in the July '45 issue—"The Hinged Motor—it always does the Right Thing"—started a mild controversy that, after several months of correspondence to and fro, has just been settled after a fashion. At any rate, I can't devote any more time or space to it. Then, a letter—"A case for good T-Slot Bolts"—in January *Gadgets* evoked a number of responses, including requests for reprints and a bulletin, on T-Slot bolts, from the Boyar-Schultz Corp'n. Apparently insignificant though an item may be, our readers seem to hunt it out.

Considerable correspondence resulted from Ed Halvorsen's article—"Chromium Plating of Cutting Tools"—in the November issue, as a result of which I'm convinced that the guy knows his onions when it comes to chromium plating. But, one letter that gave me the kick of kicks came from the Kelly Bros., a juvenile "firm" mentioned in this column a while back. It reads:

"Mr. Grams, thank you for your very welcome build up of our business. My brothers and I appreciate your support and hope to fulfill your prediciation for us.

Jack Kelly age 13
Larry Kelly age 10
Bill Kelly age 8"

Well, I've always found that if you give a boy a good name he'll try to live up to it.

Harry Whitehall, retiring Ch'man of Hamilton Chapter, called me long distance to report a grand gathering of the Curlers at their March meeting. All the Canadian celebrities were there, it seems, including Bill Dawson, Len Singer and Eric Crawford. Prex Briner was there, too, with an inspiring talk, but the general feeling was that Clete has been working too hard, which is in line with my own thinking.

In many respects, this has been the most hectic year in the history of the A.S.T.E., and the wonder of it is that several of the Society's leaders haven't cracked under the strain. But then, "he who gives his life shall have it," and the work that Clete has done, the past several years, has earned him a high niche in the A.S.T.E. Hall of Fame. And now, as the Swedes say: "May he live to his hundredth year. Skoal!"

Well, that's all for now. I'll be seeing you boys North, East, West, South at the Show, there to greet *auld acquaintance* and to form new friendships among the thousands I've yet to meet in this, the fastest growing of all technical societies. 'Til then, Au Revoir.

Andy

A.S.T.E. NEWS

NEWS OF INTEREST AND ABOUT MEMBERS

Cleveland Chapter Founders See Hopes Realized

CLEVELAND CHAPTER, now in its eleventh year, is enjoying for the second time the privilege of playing host to a National convention of ASTE, as visitors throng the city to attend the Annual Meeting and New Era Exposition, April 8-12.

Its present Chapter membership of approximately 550, centered in one of the country's greatest industrial cities, is equal to the total number of those affiliated with the National Society when the Chapter was chartered in 1935.

In the fall of that year, seven Cleveland Tool Engineers were drawn together by their common need of an association through which industrial methods, processing, and tooling might be discussed. Meeting to study their problem, they conceived the idea of becoming a part of the American Society of Tool Engineers.

The original Society, founded in Detroit, was then in the process of expanding to a national institution, an energetic group at Racine, Wisconsin, being granted a charter in October.

Two months later the Cleveland organizational group of seven had increased their numbers to 29 qualified members, chartered as the third Chapter of ASTE.

Prime movers in the formation of the Chapter were Charles Kotersall, now of Jack & Heintz Precision Industries, Inc., and Rudolph A. Fintz of White Motor Co.

Assisting them were Paul F. Zerkle of Michigan Tool Co., Paul F. Rossbach, Eaton Axle Manufacturing Co.; A. Chester Goddard, Jack & Heintz; Paul N. Shaw, Positive Safety Manufacturing Co.; and Frank H. Jeffs, Cleveland Universal Jig Co.

During the official chartering ceremonies on December 3, officers were elected and installed, Mr. Fintz becoming Chapter Chairman, Mr. Kotersall, Meetings Chairman; Mr. Jeffs, Treasurer; Mr. Zerkle, Social Chairman; Mr. Rossbach, Publicity Chairman; Mr. Goddard, Industrial Relations Chairman; Mr. Shaw, Constitution and By-Laws Chairman; and G. J. Hawkey of Cleveland Duplex Machinery Co., Secretary, and later Chairman.

Interest Sustained

The continuing interest and efforts of these founders undoubtedly were factors in the steady growth of the Chapter. Messrs. Rossbach and Zerkle subsequently served as Chapter Chairmen and National Directors. Messrs. Fintz and Goddard also occupied the latter office.

Other capacities in which the Chapter fathers have functioned include: Membership Committee, Charles Kotersall; Advisory Board, Rudolph Fintz and Paul Zerkle, and Junior Chapter Committee, Frank Jeffs.

Mr. Zerkle is now affiliated with Detroit Chapter, but Messrs. Goddard, Kotersall, Rossbach, and Shaw still retain their charter membership in Cleveland Chapter.

Venture Prospered

The judgment and foresight of these men and others who pioneered in establishing the roots of the Society is apparent in the success of their undertaking. Less than four years after Cleveland Chapter came into existence, it entertained the National organization on the occasion of the Semi-Annual Meeting in October of 1939. At that time there were 27 Chapters of ASTE.

Today, the ASTE Fourteenth Annual Meeting and New Era Exposition at Cleveland is a medium for the interchange of technical knowledge among 17,600 members in 72 Chapters throughout the United States and Canada, and in manufacturing centers around the world.

CLEVELAND CHAPTER FOUNDERS

P. F. Rossbach

Charles Kotersall

A. C. Goddard

P. F. Zerkle

R. A. Fintz

F. H. Jeffs

P. N. Shaw

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Retiring President Reviews Year's Progress at Ontario Function

Hamilton, Ont.—In a year of world and Society crisis, ASTE has made some of its greatest strides, President C. V. Briner told Hamilton Chapter March 8 when he was guest of honor at the first annual "Ladies Night" and installation of officers in the Royal Connaught Hotel.

Reviewing the outstanding events of his administration, Mr. Briner paid individual tribute to his fellow officers and others whose cooperative efforts have culminated in the revision of the outmoded Constitution and By-Laws, the phenomenally successful venture in publishing THE TOOL ENGINEER, and the sponsorship of a major trade exposition.

Other projects referred to by Mr. Briner included the "Tool Engineers' Handbook," the ASTE Directory, the long-range organizational planning, new budget control and extensive changes in the operation of National Headquarters.

He recalled how the small group of Tool Engineers who founded the Society has expanded in fourteen years to include 17,600 members, most of whom constitute the 72 Chapters throughout the United States and Canada. Others are located in foreign industrial centers.

Inquiries and applications, being received from Great Britain, Mexico, and countries cut off from communication during the war, indicate greater international growth and prestige, Mr. Briner predicted.

Assistant Secretary-Treasurer and National Director W. A. Dawson, a Chapter member, installed the following new Chapter officers: J. N. Walton, Chairman; W. A. Alexander, First Vice-Chairman; Gordon Hall, Second Vice-Chairman; John Ball, Secretary, and George Gilmour, Treasurer.

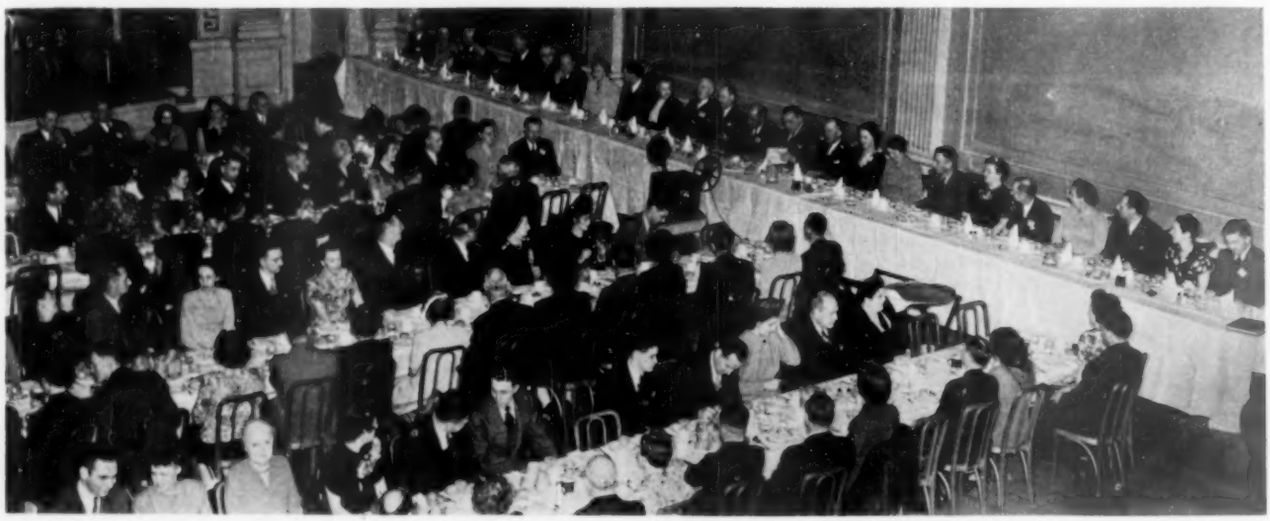
Past Chairmen Honored

Retiring Chairman Harry Whitehall, presiding officer, introduced the guests at the speakers' table and presented a Past Chairman pin and gavel to Joseph Little, one of the organizers of Hamilton Chapter, who is now an executive in Niagara District Chapter. Mr. Whitehall in turn received a Past Chairman pin, the presentation being made by Mr. Dawson.

Technical feature of the evening was an address on "Post War Lighting," delivered by G. F. Mudgett, Manager, Lighting Div., Canadian Westinghouse Co., Ltd., Hamilton.

Mr. Mudgett also demonstrated modern and unusual lighting devices and showed the Walt Disney film, "Homes of Tomorrow," which had been screened only twice previously in North America.

Out-of-town guests among the 170 attending the affair included Past Assistant Secretary-Treasurer L. G. Singer of Toronto, who introduced President Briner. Henry Hendriks and Eric Crawford, retiring Chairmen of Niagara District and Toronto Chapters, respectively, were present with Mrs. Hendriks and Mrs. Crawford.



On the occasion of Hamilton Chapter's first "Ladies Night," Chairman Harry Whitehall (top left) receives his Past Chairman pin, with National Assistant Secretary-Treasurer W. A. Dawson doing the honors. At the right, Mr. Whitehall in turn pins one of the diamond-set emblems on Joseph Little, an earlier Chairman. Below them, retiring President C. V. Briner, who was guest of honor at the March 8 meeting in the Royal Connaught Hotel, gives an encouraging report of the Society's progress during the current year. At speakers' table, from left to right, are: First Vice-Chairman John N. Walton; G. F. Mudgett, technical speaker, Canadian Westinghouse Co., Ltd.; Chairman Whitehall, President Briner (standing), Mrs. Whitehall, Mrs. W. A. Dawson, Mrs. Joseph Little, Treasurer and Mrs. Robert Young; Henry Hendriks, Chairman, Niagara District Chapter; and Treasurer-Elect and Mrs. George Gilmour. At left below, former National Assistant Secretary-Treasurer L. G. Singer introduces President Briner. Right: Mr. Dawson administers oath of office to incoming Chapter officers (left to right) Gordon Hall, Second Vice-Chairman; George Gilmour, Treasurer; William Alexander, First Vice-Chairman; and John N. Walton, Chairman. Bottom view shows some of 170 members and guests attending the function in the Royal Connaught Hotel.

Milwaukee members entertained their ladies with a dinner dance, January 26, in the Marine Room of the Elks Club. Upper left photo shows a general view of the affair. At right is the Past Chairmen's party, left to right: Mr. and Mrs. P. O. Wernicke, Mr. and Mrs. Julius Riedl, Mr. and Mrs. Harold Heywood, and Mr. and Mrs. Foster Koehn. Around center table below are Chapter officers and their wives; Chairman and Mrs. Arthur Gieringer; Treasurer and Mrs. Joseph Ebner; Mrs. J. B. Jilbert, wife of the Second Vice-Chairman who has been called away from the table; and Secretary and Mrs. Richard Ford, from left to right.

Ford New Chairman

Milwaukee, Wis. — February meeting of Milwaukee Chapter, held on the 14th in the Marine Dining Room of the Elks Club, featured the annual election of officers.

Chapter executives voted into office were: Chairman, Richard H. Ford; First Vice-Chairman, Paul Butzin; Second Vice-Chairman, Joseph E. Ebner; Secretary, Norbert Husting; and Treasurer, Herbert Heiman.

In addition Foster Koehn was named Delegate to the National Convention, with Arthur Gieringer and P. O. Wernicke tied for Alternate.

At the conclusion of the business session, L. J. Radermacher, President and General Manager of the Stokerunit Corporation, lectured on "Principles and Practice as Applied to Precision Boring Operations."

Mr. Radermacher discussed various methods of tooling Simplex precision boring machines for the production of parts requiring accurate and true holes with a tolerance of from .0002" to .0003".

After describing tooling procedures, he explained atmospherical and thermal conditions which should be considered throughout a manufacturing plant, in locating machines. The speaker showed slides and answered questions from the audience. A member of Milwaukee Chapter, Mr. Radermacher is also a National Director of the Society.

Out-of-town guests included visitors from Green Bay, Fond du Lac, Kansas City and Rockford.

Electronic Controls Seen In Reliance Plant Tour

Cleveland, Ohio—An overflow crowd of Cleveland Chapter members turned out to visit the Reliance Electric & Engineering Company for their March 8 meeting.

After dinner, served in the company cafeteria and accompanied by strolling musicians, the new Chapter officers were installed. Those taking the oath of office were: R. E. Harrold, Chairman; E. W. Baumgardner, First Vice-Chairman; H. B. Osborne, Jr., Second Vice-Chairman; H. E. Peiffer, Secretary; and J. H. Schron, Treasurer.

The coffee speaker of the evening, Roscoe "Doc" Smith, Secretary of the Reliance Electric & Engineering Co., discussed "What's Left of Industrial Germany." Mr. Smith's talk was illustrated with lantern slides, showing the devastated industrial areas through which he traveled during his recent European trip.

J. W. Picking, Electronics Development Engineer for the Reliance Company, gave the technical address on "Practical Electronics for Machine Tools."

Mr. Picking presented many uses for electronics in variable speed controls, and the control of cycles in machine operation as applied to machine tools.

Various types of Reliance electronic control units were on display to indicate their function, prior to seeing them in actual operation during the plant tour.

At the conclusion of Mr. Picking's talk, the group adjourned to the Marine Division Plant to see the controls demonstrated. This plant is a veritable laboratory for the development of electronic controls. Every type of equipment, from drill presses to multiple-head special machinery, has been equipped to operate electronically in variable speeds and by cycles, at the Reliance plant.

Physicist Anticipates Atomic-Powered Turbines

Los Angeles, Calif.—Speaking before the 169 members and guests attending the February 14th meeting of Los Angeles Chapter, Conway W. Snyder, Physicist from the California Institute of Technology, Pasadena, explained "The Atomic Bomb and Atomic Energy."

Mr. Snyder stressed the fact that the Atomic Age is now; that, with our present knowledge, steam turbines powered by atomic energy can be developed and that greater advances can be expected in the near future.

In common with all scientists, he advocates placing the atomic development under international control in order to prevent the destruction of civilization.

His talk was followed by the election of Chapter officers for '46-'47, and a Delegate to the national convention. In the balloting for officers, Anton Peck was elected Chairman; Leslie Hawes, First Vice-Chairman; Gerald Stronks, Second Vice-Chairman; Virgil Weideman, Secretary; and George Walkey, Treasurer. Arthur Lewis, retiring Chapter Chairman, was chosen Delegate.

Following the annual election of officers by Los Angeles Chapter members February 14th, Arthur Lewis, retiring Chairman, hands gavel to his successor, Anton Peck. Officers-elect standing behind them are, left to right: Gerald Stronks, Second Vice-Chairman; Leslie Hawes, First Vice-Chairman; and George Walkey, Treasurer.

Starrett Advances To Presidency

Athol, Mass.—Arthur H. Starrett recently was elected President of the L. S. Starrett Company, internationally-known tool manufacturers.

A. H. Starrett

Mr. Starrett, of the third generation, started with the company in 1902; was appointed Master Mechanic in 1920; made a Director two years later; and became Vice-President in 1939.

He is on the Executive Committee of the Associated Industries of Massachusetts and of the National Metal Trades Association, and a member of Worcester Chapter, ASTE.

William P. Kirk, NMTBA President, chats with ASTE officers during dinner which preceded his address before February 11 meeting of Northern New Jersey Chapter in Robert Treat Hotel, Newark. Left to right are: Thomas P. Orchard, Third Vice-President, ASTE; John Webster, First Vice-Chairman; Mr. Kirk, Frank Delhagen, Chairman; and Andrew G. Staller, Treasurer.

Output Must Keep Pace With Wages, Kirk Says

Newark, N. J.—Postwar possibilities can be realized to their fullest extent only on the basis of maximum productivity, William P. Kirk, President of the National Machine Tool Builders Association and Vice-President, Pratt & Whitney, Div. Niles-Bement-Pond Co., West Hartford, Conn., told Northern New Jersey Chapter, February 11, in a meeting at Robert Treat Hotel.

Scores Scarcity Theory

"There are many people in this country," Mr. Kirk said, "who seem to have the idea that wage rates and employment levels can best be maintained by limiting productivity per man per hour. This is an economic fallacy. The fact is that in the long run real wage rates and employment levels can be increased only in proportion to the extent to which productivity per man per hour can be increased.

"The reasoning behind this fact is far deeper than a principle of economics," Mr. Kirk asserted. "The basic reason is that there is no limit to human desires. The more things people want, that can be offered to them at prices they can afford to pay, the larger will be the volume of business, and the greater the assurance of high wage and employment levels.

"The machine tool industry holds the key to this whole social and economic picture, because machine tools represent the key to cutting costs, increasing productivity, and lowering prices to the ultimate consumer," he said.

Emphasizing that the Machine Tool Builders Association has done its utmost to cooperate with the government in the disposal and placement of war-built, government-surplus machine tools, Mr. Kirk summarized: "The sooner we can get government-owned machine tools out onto factory floors and producing on behalf of greater volume and lower costs, the better it will be for our national economy and for the machine tool industry itself."

Among guests present was Thomas P. Orchard, Third Vice-President of the Society and a member of Greater New York Chapter.

Coming Meetings

BALTIMORE—Spring Dance, May 10.

CHICAGO—Annual Ladies Night, May 6, Furniture Club of America. Dinner, 7:00 P.M. Tickets, $2.50 per person. Reservations limited to 300.

DAYTON—Old-timers Night, May 13, honoring charter members, old-timers, and Past Chairmen. Speaker: Clinton V. Johnson, Manager, Engineering and Sales, Johnson Gage Co., Bloomfield, Conn.

NEW HAVEN—May 9, Chi Psi House. Dinner, 6:30 P.M., technical session, 8:00 P.M. Speaker: Oscar E. Koehler, Chief Engineer, Cutting Tool Div., Greenfield Tap and Die Corp., Greenfield, Mass. Subject: "Screw Threads and Tap Design."

RICHMOND—April 16, 6:45 P.M., Leland Hotel. Speaker: Clifford C. Bradbury, Patent Attorney, Williams, Bradbury & Hinkle, Chicago, Ill. Subject: "Patents and Patent Contracts."

SYRACUSE—May 14, Hiawatha Room, Onondaga Hotel. Speaker: J. I. Karash, Plant and Process Engineer, Reliance Electric and Engineering Co., Cleveland, Ohio. Subject: "Analysis of Drill Jig Design," illustrated with blackboard drawings and slides.

Diamond Wheel Specialist With Bay State Abrasive

Westboro, Mass.—C. K. Worthen is now associated with the Bay State Abrasive Products Company, as a specialist on diamond vitrified, resinoid, and metal bonded wheels.

C. K. Worthen

Previously he was employed by Felker Di-Met Company of Torrance, Calif., and Norton Company, Worcester, Mass.

A Detroit Chapter member of the Society, Mr. Worthen lectures before ASTE groups on the subject of "Diamond Wheels and Diamond Wheel Applications."

Installation Night

Decatur, Ill.—An installation dinner in the Decatur Club preceded the technical session held March 11 by Decatur Chapter.

Retiring Chairman Harry Williams inducted the following new officers: Chairman, E. C. White, Decatur Pump Co.; First Vice-Chairman, Ray Howell, Oakes Co.; Second Vice-Chairman, Fred Sabottka, Grigoleit Co.; Secretary, Jasper Miller, Mill Supply Co., Decatur; and Treasurer, Fred Hardy, Sta-Rite Co., Shelbyville.

Technical speaker was Thomas D. Detherow of the Chicago office, Bryant Chucking Grinder Co., Springfield, Vt. His subject, "Better Tooling for Internal Grinding," was illustrated by a film at the conclusion of the open discussion period participated in by many of the 40 persons attending the meeting.

Dues Collections Soar

Detroit, Mich.—Dues paid by ASTE members have reached a new high this year, National Treasurer W. J. Frederick reports.

Collections exceed those of any previous year both in volume and promptness, more than 65% of the membership having responded during January and February to the annual year-end billing.

Remittances received during March, untabulated at press time, increase this percentage appreciably.

New legislation embodied in the recently-revised Constitution and By-Laws shortens the grace period to four months and establishes the Society's Accounts Receivable on a more business-like basis.

Installation of a mechanical accounting system has facilitated both billing and crediting of accounts.

W. J. Frederick

A. M. Schmit

Members, who through inadvertence may be unaware of the new constitutional stipulation, are reminded by National Secretary A. M. Schmit that April 30 is the last day of grace for paying 1946 dues.

Secretary Schmit has also advised Chapter Secretaries to contact such members in order that their ASTE affiliation may not lapse through oversight.

In his letter, accompanying the Chapter Roster sent to each Chapter Secretary, Mr. Schmit quotes the paragraph beginning on Line 17, Page 2, Division 2 —By-Laws, and reading:

> "Any member who shall neglect or refuse to pay his dues for a period of two months from the date of invoice shall receive a final notice from the Secretary advising the delinquent of the action which must be taken. If the dues shall remain unpaid for a period of four months, the member shall be automatically dropped from membership in accordance with Division 1, Page 3, Line 1, of the Constitution."

The latter passage lists non-payment of dues as cause for dismissal from membership.

Engineer's "Syzygy" Brainard's Topic

Fort Worth, Tex.—W. E. Brainard, Chief Tool Engineer, Consolidated Vultee Aircraft Corp., addressed the February 15 meeting of North Texas Chapter, held in the Lone Star Gas Company Auditorium. His subject was "The Syzygy of the Tool Engineer."

The following Chapter officers were elected for the coming season: Chairman, Fred Bates, Jr., Tool Project Engineer; First Vice-Chairman, Theodore A. Hersh, Supervisor, Tool Research and Standards; Treasurer, John A. Lapham, Process Analyst, all of Consolidated Vultee Aircraft Corp., Forth Worth; Second Vice-Chairman, Laurence H. Leinbach; and Secretary, Irving H. Buck, Owner, Tool Supply and Engineering Co., Dallas.

600 ASM-ASTE Members Hear Magnesium Program

New York City—In cooperation with the Machine Shop Division of the New York Chapter of ASM, Greater New York Chapter, ASTE, presented a symposium on "magnesium," January 16, in the Hotel New Yorker.

C. O. Herb and J. D. Schiller, of the ASM and ASTE groups, respectively, were Technical Chairmen of the program sponsored by Dow Chemical Co., Magnesium Div., Midland, Mich.; Hills-McCanna Co., Foundry Div., Chicago, Ill.; and Revere Copper and Brass, Inc., New York City.

Various Phases Discussed

James B. Reid, Sales Engineer for Dow Chemical, spoke on "Engineering with Magnesium," followed by Edwin Rause, Assistant to Vice-President-Manufacturing, Revere Copper and Brass, who discussed "Wrought Magnesium Alloys, Their Fabrication, Properties and Uses." "The Past, Present, and Future of Magnesium" was outlined by Dan W. Moll, Vice-President and Treasurer of Hills-McCanna. Mr. Moll illustrated his talk with the sound film, "Magnesium—The Miracle Metal."

Other speakers were A. Cristello, Foundry Manager, Eclipse-Pioneer Div., Bendix Aviation Corp., Peterboro, N. J.; A. A. St. John, Metallurgist, Federated Metals, New York City; and C. E. Larson, General Manager, White Metal Rolling and Stamping Corp., Brooklyn, N. Y.

Educational Exhibit

Center of interest was a display of magnesium sand, permanent mold and die castings, sheet, rod, tubing, and extrusions exhibited by the participating companies.

Many of those present entered the "Guess the Weight Contest" to determine the combined weight of blocks of bronze, iron, aluminum, and magnesium, and a pretty girl. Incentive for the competition was a Victory Bond award.

The meeting attracted an attendance of approximately 600 members and guests of the two engineering societies.

Kaufman Talks On "Steels"

Syracuse, N. Y.—Dwight Kaufman of the Crucible Steel Company of America was the technical speaker at the February 12 meeting of Syracuse Chapter. His subject was "Tool Steels and Their Treatment."

The meeting, held at the Onondaga Hotel, was attended by 52 members.

South Africa Must Create Peacetime Industry To Maintain War-Compelled Production

Johannesburg, U. of S. Afr.—Conversion to a peacetime industrial economy that never existed prewar is the big problem facing South Africa, according to P. J. van Vuuren of the Alpha-Harris Engineering Co., Ltd., and an At-Large member of ASTE.

P. J. van Vuuren

In describing his country's development as a producer of war materiel, Mr. van Vuuren said, "Manufacturing in South Africa was very limited until 1939. With war came the enormous demands for ammunition and other military supplies. Like many other countries we were ill-equipped. With imports largely cut off, there was no alternative but to manufacture articles formerly secured from abroad."

Improvised Tooling

Lacking the necessary equipment, machine tools had to be made locally and substitutions devised. In some instances tools were used on work for which they were not suited or intended, Mr. van Vuuren pointed out.

"Taking into consideration all the difficulties, production got under way fairly quickly," he continued. "All over the country small engineering shops were turned into batch production shops for the manufacture of shells, hand grenades and other ordnance."

Mr. van Vuuren quoted figures indicating that 5768 armoured cars were produced, requiring the fabrication of framework, armour plating of bodies and turrets, as well as complete equipment, ready for military use.

Importer Turned Manufacturer

"As an example of changes resulting from the war," Mr. van Vuuren related, "I might cite the case of a firm engaged in importing and repairing electric motors. At the outbreak of the war in 1939, they had only a dozen employees, but on V-J Day their staff numbered over 700.

"For the five-year period from 1940 to 1945 they manufactured 8500 units consisting of squirrel-cage and slip-ring electric motors, 1 hp to 375 hp; generators, ½ kw to 250 kw; alternators, 15 kva to 250 kva; transformers, 1 kva to 500 kva; arc welders, d-c, 200 amp to 400 amp; a-c transformer arc welders, 150 amp to 400 amp; and 1000 amp plating generators.

"All the work on these units was executed by this firm," Mr. van Vuuren added, "except casting and the manufacture of transformer tanks and switch gear. A very high standard of workmanship was attained through an efficient inspection system and a thorough testing of each unit after assembly. As a result, production compared very favorably with foreign imports.

"Production," he concluded, "was all of a batch nature, the largest single lot being 2000 units turned out in excellent production time."

Consumer Production Problem

Difficulties involved in these achievements were no greater, in Mr. van Vuuren's opinion, than the present problem of establishing a civilian industry to utilize the facilities developed for military production.

Prior to Mr. van Vuuren's association with the Alpha-Harris concern in designing jigs, fixtures, special testing equipment and components to reduce production and assembly times, he was connected with the General Engineering Works of Johannesburg. There he was in charge of plant erection, construction and fabrication.

Earlier he served the Rand Mining Timber Co., Piet Retsef, Transvaal, in directing plant transportation, and designing and fabricating four- and six-spindle drilling machines.

Hogan Officer-Manager Brunner Machine and Tool

New York City—John J. Hogan of White Plains, formerly Assistant Superintendent of Otis Elevator Co., Yonkers, where he was employed for more than twenty-five years, has been named Vice-President and General Manager of the Brunner Machine and Tool Co.

J. J. Hogan

A consultant for the Reconstruction Finance Corporation, on equipment and tools in New York, New Jersey and Connecticut, Mr. Hogan served as Chairman of the Advisory Board, White Plains National Defense School.

He is a Past Chairman of Greater New York Chapter, ASTE, and was recently elected a National Delegate. During the war he chairmanned the Tool Engineering Panels conducted by ASTE as part of the WPB conferences held in the New York area.

Audience of 600 engineers and their guests who turned out for the January 16 magnesium symposium sponsored by the New York Chapters of ASM and ASTE, listen intently to one of the several technical speakers appearing on the program. At left is James B. Reid, Dow Chemical Company representative. Speaker at the right is Dan W. Moll, Vice-President and Treasurer, Hills-McCanna Company. Magnesium parts exhibit supplemented lectures.

Manuscript Review Committee Studies Handbook Material

HEADED BY. PROF. O. W. BOSTON, Chairman of the Department of Metal Processing, at the College of Engineering, University of Michigan, Ann Arbor, the Manuscript Review Committee for the "Tool Engineers' Handbook" has begun its examination of completed manuscripts.

O. W. Boston

Working with Professor Boston are Dr. John J. Caton, retired Director and Founder of the Chrysler Institute of Engineering, and O. B. Jones President of the Detroit College of Applied Science and Founder and Historian of ASTE.

To this nucleus will be added such other specialists as the Committee may from time to time consider essential to the Handbook's most critical review.

J. J. Caton

O. B. Jones

After the Committee checks each paper for accuracy, proper reference to established standards, correctness of formulas, tabulations and related matters, special sub-committees in industry will double-check the material for inclusiveness of data and practical usefulness.

Among the many contributors whose manuscripts will be studied by these committees are:

Dr. Derso S. Shybekay, Vice-President of the Industrial Research Council, and Director of Market Research for the North Star Woolen Mill Co., Minneapolis, who has distinguished himself in the field of organizational work, education and industry.

Educated Abroad

Although he returned to his native Hungary for his higher education, Dr. Shybekay received his primary schooling at Brooklyn, New York. In this country he also did post-graduate work at Brooklyn College of New York, City College of New York, University of Chicago, Illinois Institute of Technology and De Paul University.

A graduate in engineering from the University of Budapest, he received his Doctor of Economics and Doctor of Universi Juris Degrees from that institution. His Doctor of Philosophy Degree was conferred by the University of Berlin where, as a Docent, he taught Industrial Organization and Business Administration.

Leaving his position as top executive of the *Berliner Tageblatt* after fourteen years' association, he came to the United States to assume duties as Secretary and Conference Leader for the American Business Forum.

After three and a half years, he resumed his teaching activities, giving instruction in Management, and Supervision and Production at the University of Alabama.

Varied experience as an Industrial Engineer followed at Erie Basin Metal Products, Elgin; Batavia Metal Products, Inc., Batavia; The Todd Mfg. Co., Chicago, Ill.; and Economy Grocery Store, Boston, Mass.

Returns to Teaching

In 1943, with the added knowledge secured in these positions, Dr. Shybekay joined the faculty of Purdue University, Lafayette, and the University of Indiana, Bloomington, Ind., teaching Management, Supervision and Production, and Applied Psychology to Industry.

Last September he made his present connection with the North Star Woolen Mill Co.

A Registered Professional Engineer and a Practicing Professional Industrial Engineer, Dr. Shybekay is affiliated with 24 engineering, honorary, educational, and business organizations, including ASTE. Formerly associated with the Society's Fort Wayne Chapter, he is now a member of the Twin City group. In England he is a Fellow of the Royal Economic Society of Great Britain.

D. S. Shybekay

As an author, he has had more than a score of books published, covering a wide range of industrial and economic subjects. Dr. Shybekay's contribution to the "Tool Engineer's Handbook" will be in the section devoted to Tool Engineering Economics.

* * *

Beginning his professional career early in 1932 when industry was in the doldrums and the first vague plans were being conceived for the organization of ASTE, **Wallace F. Ardussi** has, in the intervening 14 years, risen to a Vice-Presidency in the Hupp Motor Car Corporation of Detroit.

Elected to this office in February, 1945, Mr. Ardussi is in charge of Sales and Engineering, correlating problems for plants in both Detroit and Cleveland.

W. F. Ardussi

This connection follows a year's service with the Industrial Rayon Corporation of Cleveland, as Chief Engineer, a position he assumed when he went to that city late in 1943. Here he headed up engineering activities concerning continuous process rayon spinning machines and other mechanics relating to the production of rayon.

Promoted Research

Earlier he organized and directed the Department of Research and Engineering at Foote Bros. Gear and Machine Corp., Chicago, Ill., re-designing and modernizing products.

As Manager of the Aircraft Devices Division, he established and operated for his company a new enterprise serving the aircraft industry.

For nine years until April, 1941, Mr. Ardussi was associated with the Airtemp Division of Chrysler Corp., Dayton, Ohio. His initial assignment was as Research and Development Engineer, with subsequent promotions to Manufacturing and Production Research Engineer, and Assistant to the President and Assistant Sales Manager.

In addition to his membership in ASTE, Cleveland Chapter, Mr. Ardussi is affiliated with SAE, ASM, the Wings Club, Iota Alpha and Honorary Engineering Research fraternities.

His B.S. and M.S. in Chemical Engineering, conferred by the University of Michigan, were followed by a Master Mechanical Engineering degree from Chrysler Institute of Engineering.

* * *

After specializing in various phases in Industrial Engineering for three years following his graduation from Northeastern University, Boston, **David Anderson** went to Bulova Watch Co., Woodside, Long Island, N. Y., well equipped for his duties as Chief Industrial Engineer.

Developed New Procedures

Functioning in this capacity since 1942, Mr. Anderson has been concerned with the installation and supervision of industrial engineering activities relating to work simplification and job standardization, time and motion study, job evaluation, and wage incentives, as well as the inauguration of planning and production control procedures.

He is a member of the American Management Association and co-author of a number of articles on time and motion study and job evaluation, including "Common Sense in Job Evaluation," "The Right and Wrong of Time Study Computation," "Method Simplification Applied to Time Study," and "Your Incentives Will Work if Properly Planned."

David Anderson

* * *

A substantial contributor to the successful solution of gear problems during the development of Allison engines for war production, **Richard S. Kegg,** Production Engineer, Allison Div., General Motors Corp., Indianapolis, Ind., is the author of several articles on manufacturing gears and gear analysis.

R. S. Kegg

When the Society met in Indianapolis for its Semi-Annual Meeting in 1943, Mr. Kegg addressed a technical session, lecturing on "Manufacturing Allison Aircraft Engine Gears." This paper was subsequently published in THE TOOL ENGINEER.

He acquired some of his gear experience with Spicer Manufacturing Corporation, prior to his association with Allison in 1940.

Mr. Kegg received his Mechanical Engineering education at Indiana Technical College, Fort Wayne. He is an active member of Indianapolis Chapter, ASTE.

F. O. Hoagland, Pratt & Whitney, West Hartford, Conn., (left) explains "Jig Boring and Related Problems" to Richmond Chapter members. A popular Chapter speaker, Mr. Hoagland addressed the March 12 technical session in the Leland Hotel. Right: New Chapter officers are installed by National Treasurer W. J. Frederick. They are (left to right): Claude M. Crane, Second Vice-Chairman; Harvey V. Murphy, Treasurer; Louis F. Wahl, First Vice-Chairman; Lowell B. Penland, Secretary; and Jesse Johnson, Chairman. Facing officers are Mr. Frederick (left) and Roland E. Lockridge, retiring Chairman.

More Work at Lower Cost With Shankless Drills

Racine, Wis.—March meeting of Racine Chapter was held the evening of the 4th, following a dinner at the Manufacturers Association Building.

National Director L. J. Radermacher installed as Chapter officers for the coming year, Alfred Nelson, Chairman; Ray Fisher, First Vice-Chairman; Nels Sorenson, Second Vice-Chairman; Robert Calkins, Treasurer; and Fred Stienbrecker, Secretary.

Mr. Radermacher spoke briefly on Chapter affairs and the Society's Exposition at Cleveland.

C. E. Jacobsen of Jacobsen & Daw, General Sales Agents for Republic Drill and Tool Co., Chicago, was the principal speaker of the evening, using "Shankless Drills" as his subject. An interesting film, showing the manufacture of these drills, illustrated his address.

Advantages of this method of drilling, highlighting Mr. Jacobsen's talk, were: more inches of usable flutes, more holes per drill grind, and lower cost over conventional types of drills, because less steel is required for shankless drills. Mr. Jacobsen also introduced the new jet drill being developed by Republic.

An audience of approximately 65 members heard Mr. Jacobsen's lecture.

Brown New England Agent For National Broach

Detroit, Mich.—Richard S. Brown of Wilbraham, Mass., has been appointed exclusive agent by the National Broach & Machine Company, for the entire New England area, with the exception of Connecticut.

R. S. Brown

Mr. Brown has been associated with the General Machinery Corporation of Boston for the past three years, and was the Western New England Representative for Henry Patterson Company, Inc., until that firm discontinued operation in 1942.

He has been active in machine tool sales work and associated activities since his graduation from the University of Cincinnati in 1927.

A member of ASTE, Mr. Brown has served as Second Vice-Chairman and Industrial Relations Chairman of Springfield (Mass.) Chapter. He also was active on the Banquet Committee for the ASTE Semi-Annual Meeting held at Springfield in October of 1942.

Hydraulic Control Needed For Heavy Equipment

South Bend, Ind.—L. R. Twyman, Manager, Industrial Div., Vickers, Inc., Detroit, Mich., addressed South Bend Chapter, February 12, at their dinner meeting in the Indiana Club. Mr. Twyman's subject was "Hydraulics in Conjunction with Machine Design."

L. R. Twyman

In his discussion, Mr. Twyman stated that hydraulic power is used principally in converting electrical energy into rotary and linear motion, the present alternating current electrical system readily lending itself to the production of power through constant speed motors. To change speeds or produce straight line motion, the hydraulic system is used. Self-lubrication and the ability to transmit power around corners are advantages of hydraulic systems, Mr. Twyman pointed out.

Fluid Extends Tool Life

When hydraulic cylinders are used for feeding tools against the work, he explained, the tool life is lengthened through shock absorption by the hydraulic fluid. Great flexibility is possible in hydraulic systems because the operator can make minute adjustments by inching the tools up to the work.

A very effective braking system, the speaker added, can be arranged by simply stopping the flow of the liquid. Another outstanding advantage is the low weight of hydraulic cylinders and pistons, small amounts of inertia being involved in starting and stopping these members.

Hydraulic systems are widely used, Mr. Twyman continued, on automatic and semi-automatic machines because the various components of the machine can be arranged to work in any sequence by the use of controlled valves and other cycling arrangements. Loading and clamping fixtures may also be tied in with the timing of the machine operation.

Wartime demand, he observed, brought about the development of hydraulic devices on practically all large aircraft. Used for opening bomb doors, driving gun turrets and other miscellaneous operations, many of the new contrivances will be adapted to the manipulation of farm equipment and heavy motor truck steering. Wherever there is a need for accurate control of heavy equipment, the hydraulic system will be in constant demand, Mr. Twyman concluded.

Hoagland Describes Gun Barrel Boring

Richmond, Ind.—March meeting and installation of Richmond Chapter officers took place on the 12th in the ballroom of the Leland Hotel.

Rev. Albert H. Keck of St. Paul's Lutheran Church gave the invocation preceding the dinner.

Retiring Chairman Roland E. Lockridge spoke briefly on the success and growth of the Chapter in the year and three months of its existence, thanking his executive officers for their efforts.

In conclusion, he introduced National Treasurer W. J. Frederick who swore in the following new officers: Jesse Johnson, Chairman; Louis F. Wahl, First Vice-Chairman; Claude M. Crane, Second Vice-Chairman; Harvey V. Murphy, Treasurer; and Lowell B. Penland, Secretary.

After being installed, Chairman Johnson turned the meeting over to Entertainment Chairman LeGrand Terry who introduced the technical speaker, F. O. Hoagland, Master Mechanic, Pratt & Whitney, Div., Niles-Bement-Pond Co., West Hartford, Conn.

In his lecture, "Jig Boring and Related Problems," Mr. Hoagland discussed the various standards of measurement in use here and abroad from early times to the present. Of particular interest was his description of the boring of gun barrels.

The speaker showed a number of slides depicting operations performed by jig boring machines. He also placed special emphasis on the correct dimensioning of drawings as a means of saving time by eliminating the necessity for the machine operator to do his own figuring.

Mr. Hoagland's entire talk was interspersed with witticisms, stressing points which otherwise might have been difficult for his listeners to grasp.

The meeting was concluded with the showing of the sound film, "Highlights of the 1945-46 World's Series Between the Detroit Tigers and the Chicago Cubs."

There were approximately 75 in attendance.

Joins Standards Committee

Detroit, Mich.—Leslie B. Bellamy, of Detroit Chapter, has been appointed to the National Standards Committee by Chairman W. H. Smila.

L. B. Bellamy

Mr. Bellamy, who is very active in the Society, has chairmanned Detroit Chapter Standards and Education Committees for several years.

As a member of the Data Sheet Sub-Committee, he has worked constructively in the production of a suitable index for the Society's data sheets.

The new Standards committeeman is well-qualified by background and experience for his office. He is associated with the Sterling Grinding Wheel Div., Cleveland Quarries Co., Tiffin, Ohio, as Technical Advisor for the Michigan area.

Previously he was Standards Superintendent for Packard Motor Car Company, Detroit.

FILM FLASHES

Mass Production of Massive Parts is the title of a recently released 16 mm. sound and color film. The motion pictures portray the possibilities of fabricating very heavy parts for equipment of all kinds of means of Thermit welding.

Sequences filmed at The California Shipbuilding Company during the war show the methods employed in building thousands of 40-ton stern frames for cargo ships. Prints are available without charge for showings to engineering and technical societies, by request to Metal & Thermit Corporation, 120 Broadway, New York 5, N. Y.

* * *

Metal Magic—A swarthy blacksmith of the old school blinks his eyes in amazement as a trim young lady demonstrates the versatile accomplishments of the modern induction heater in this new, full-color sound film.

As evidenced by this film, induction heating, properly applied, offers industry a remarkable tool for surface hardening, annealing, brazing, soldering, melting and heating for forging because it produces high-intensity, controlled heat without inflammable gases.

Speed of operation and ease of control of the unit shown in the motion pictures is emphasized in its demonstration by an unskilled girl.

Running time of "Metal Magic" is 12 minutes. Prints for 16 mm. sound projectors may be had by writing the Advertising Dept., Allis-Chalmers Mfg. Co., Milwaukee, Wis.

* * *

The Miller That Uses Its Head—Just completed in sound and color by W. H. Nichols & Sons, this educational film is designed primarily to show tool engineers some of the multitudinous applications of the hand miller, for rise-and-fall spindle heads.

Unlike many technical films, this is not a "how-to-operate" film, but is an analysis of the hand miller from the tool engineer's and tool designer's point of view. It shows many kinds of tooling and fixture designs, all the way from simple stock fixtures to completely automatic fixtures, such as one for planing a double-start helix on a fuel injector plunger.

The film runs for 23 minutes and is available for showing at ASTE meetings by contacting Nichols-Morris Corp., 50 Church Street, New York City.

Now—the Peace is a dramatic screen story of the global plans for peace, endorsed by leading civic, church, labor, community and school organizations. Clarifying basic aspects of the organization and program of the United Nations Organization, the production stimulates discussion and understanding of the evolving patterns for building peace.

The motion pictures combine effective animated figures with live action scenes to create a powerful statement of the great challenge of our times: the building of a peace that is real and indivisible.

The film contrasts the powers and plans of the U.N.O. with the failure of the League of Nations, showing that, through joint action in solving relief, food and money problems, we can help to rid the world of conditions that breed war.

The two-reel film was written and directed by Stuart Legg, for the National Film Board of Canada. Prints may be rented from Brandon Films, Inc., Public Affairs Division, 1600 Broadway, New York City or from any of the regional service points comprising the national distribution network.

Production Planners

Philadelphia Tool Engineers active in the development of the postwar program for William Sellers Company, Inc., are, left to right, seated: George Boldt, Process Engineer; Charles Swartz, Designer; and Isadore Tavelman, Tool Room Foreman. Standing: Eric Price, Works Manager; John W. Noble, Tool Engineer and retiring Chairman of Philadelphia Chapter; and Leslie Thompson, Production Coordinator.

New products under way in the Sellers organization include a paper coating machine, metal stamping dies for the automobile industry, and catapults for launching Navy target planes. Another new venture is the creation of a hydraulic and special machinery division to develop machinery and molds for the plastic industry.

'Crush Dressing' Program Draws Large Attendance

Chicago, Ill.—The largest turnout of members and guests at any recent meeting of Chicago Chapter heard Carl G. Linxweiler and R. Y. Moss of The Sheffield Corp., Dayton, Ohio, discuss new developments in procedures for "crush dressing" grinding wheels, at the March 4 dinner meeting in Huyler's Restaurant.

R. Y. Moss

C. G. Linxweiler

The speakers pointed out that "crush dressed" wheels are sharper and cut cooler than do wheels dressed with conventional diamond dressing tools, and that multiform wheels for reproducing intricate shapes can be dressed accurately and economically by this method.

New Chapter officers installed at this meeting were: Chairman, Clare Bryan, Consulting Tool Engineer, Link-Belt Co.; First Vice-Chairman, Fred J. Schmitt, Sales Manager, D. A. Stuart Oil Co.; Second Vice-Chairman, Harold M. Taylor, Vice-President, Supplies, Inc.; Secretary, Ray Erickson, Tool Engineer, Signode Steel Strapping Co.; and Treasurer, Anton Schwister, District Manager, Greenfield Tap & Die Corp.

Following induction of the new executives, Mr. Bryan announced the following appointments as committee chairmen: Membership, Tom Barber, Owner, Tool Service for Industry; Education, M. V. Sheldon, General Manager, Gagefix Manufacturing Co.; Constitution and By-Laws, Roy R. Hoefer, Owner, Roy R. Hoefer Co.; Editorial, Harry Nelson, Vice-President, Charles L. Anderson Machinery Co.; Public Relations, Ben C. Brosheer, Associate Editor, *American Machinist;* Standards, Frank M. Kincaid, Technical Supervisor, Dodge Chicago Plant; and Entertainment, Walter O. Will, President, Tools, Inc.

New Engineering Firm Offers Patent Service

San Jose, Calif.—William J. Mix, Sr., has opened the Wilmix Engineering offices, specializing in machine design, plant layout, and other phases of production manufacturing.

W. J. Mix, Sr.

A complete analysis of patents and infringements also will be provided by the new concern.

Mr. Mix, who came to the West Coast in 1941 to supervise the tooling of the B-29's, has been engaged for the past year on a Joshua Hendy Iron Works secret project, at Stanford University.

A member of Los Angeles Chapter, ASTE, he is a Registered Professional Engineer.

Surplus Tool Buying Explained in NMTBA Brochure

Cleveland, Ohio — Suggested procedures for purchasing government-owned surplus machine tools have been compiled in a 21-page booklet by the National Machine Tool Builders' Association. Title of the publication is "How to Buy Surplus Machine Tools."

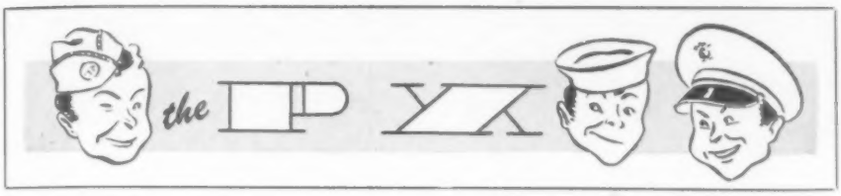
In question and answer form, the brochure gives information concerning tools available, location, description, condition, prices, terms, delivery and priorities.

The pamphlet also contains a list of Surplus Sales and Information Offices throughout the country, with the name, address and telephone number of the official to be contacted at each office.

A formula is included for determining prices of surplus machine tools, according to the period such tools have been in active use.

Descriptive references to government regulations affecting the sales of surplus tools are also given.

Copies of the booklet are available upon application to the Association's offices at 10525 Carnegie Ave., Cleveland 6, Ohio.



U. S. Naval Special Hospital
Palm Beach, Florida

PX Editor
Dear Sir:

Having read one of your latest issues of THE TOOL ENGINEER, *I've begun to realize, even more, the tremendous help it will be to me in civilian life.*

E. D. Carmagnola

Though in the Navy I received training as Radio Technician, my toolmaking and tool designing experience was always with me, helping to overcome any mechanical difficulties which might confront us.

I look forward to receiving my Honorable Discharge and returning to the Tool Engineering field. With the splendid cooperation of ASTE, I can't help but succeed.

Fraternally yours,
Ernest D. Carmagnola S2/c (RT)
Greater New York Chapter

* * *

ASN 31449364
190 2nd *Eng. Av. Bn.*
APO 929, *San Francisco*

Dear Sirs:

I want to thank the ASTE for the Armed Forces membership card and more particularly for the courtesy of continuing to send THE TOOL ENGINEER. *As the only link with the civilian profession, it is always very welcome. Unfortunately your lead was never followed by some of the other engineering societies.*

I spent ten weeks in Nagasaki with the 1298th Engineers and had a first rate chance to see what the atomic bomb can do. Interesting to Tool Engineers is the fact that a considerable proportion of machine tools in the numerous shops around the damaged area could have been saved if personnel had been available to protect them from the weather.

At present I am draftsman in the Engineer section of an Engineer Aviation Battalion located a few miles outside of Fukuoka, the principal town of Kyushu. This doesn't prevent it from being a dismal, lifeless place, and I'm looking forward to leaving both town and country for the good old U. S.

Sincerely,
Erwin G. Loewen
Little Rhody Chapter

* * *

526 *Middle Avenue*
Wilmerding, Penna.

Dear Sirs:

I wish to thank you for sending my copy of THE TOOL ENGINEER *to me each month while being overseas.*

For the past few months I have been stationed in Shanghai, China. While our ship was in dry dock a few miles up the Whangpoo River, I had the pleasure of visiting a few ship repair machine shops. It was interesting to see the good work produced in these shops with the machinery available.

This equipment was mostly of English, Chinese, Japanese, and German manufacture. I don't recall seeing any American-made machinery and very few tungsten carbide tools. What carbide tools these repair shops had were left by the Japanese who operated them until the early part of last year. China should be a good postwar prospect for our machinery and cutting tools.

I have just returned to the States and am expecting my discharge in April. Please forward THE TOOL ENGINEER *to my home address.*

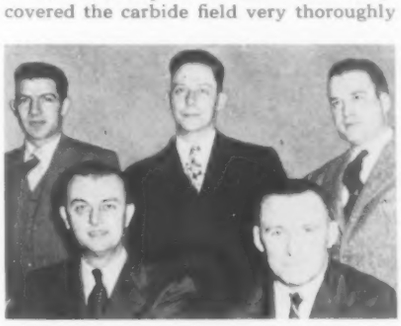
Yours truly,
Ray W. Shenefelt, F 1/c
Pittsburgh Chapter

Kotarba Elected Chairman

Buffalo, N. Y.—The annual election of officers was conducted at the February 21 meeting of Buffalo-Niagara Frontier Chapter. Successful candidates were: Martin W. Kotarba, Chairman; Arthur S. Twombly, First Vice-Chairman; Carl F. Maute, Second Vice-Chairman; Irwin T. White, Secretary; and Garrett Kingston, Treasurer.

The technical program was presented by Philip McKenna, President, and Joseph F. Timmerman, Field Representative, Kennametal, Inc., Latrobe, Pa.

Their subject, "Cemented Carbides, Latest Developments and Practices," covered the carbide field very thoroughly



Buffalo-Niagara Frontier Chapter elected these executives to head up the Chapter for the coming year at February 21 meeting in Hotel Markeen. Left to right, standing, are: Irwin T. White, Secretary; Garrett Kingston, Treasurer; and Carl F. Maute, Second Vice-Chairman. Seated are: Arthur S. Twombly, First Vice-Chairman; and Martin W. Kotarba, Chairman.

from the analysis of the structure of carbides before sintering, to the actual use of the carbide cutter on a machine tool, with special emphasis on negative rake.

Considerable discussion followed concerning the use of carbide for actual die work and the advantages of bolted carbide tool tips over brazed tips.

During the evening, National Education Chairman Otto W. Winter made an appeal for back issues of THE TOOL ENGINEER and other technical periodicals and books for donation to the University of Buffalo.

Approximately one hundred members attended the dinner at the Markeen Hotel.

Wins Damon Award

Fort Wayne, Ind.—Fred H. Gordon of Bowser, Inc., and a member of Fort Wayne Chapter, ASTE, was named co-winner of the Damon Award at a dance given by the company at the Fort Wayne Athletic Club, February 23.

F. H. Gordon

Presented annually for the most outstanding money-saving suggestion adopted during the year, the award was conferred on Mr. Gordon and Robert Burns, who assisted in the development of the idea, by Marshall Dale, Executive Vice-President of the Bowser company.

Basis for the award was an improvement in the design of the Bowser Pump base, formerly made of stampings, welded and ground. The new, one-piece base embodies an entirely new principle of support and stress distribution. Messrs. Gordon and Burns both conceived the same idea for the change in design which they developed cooperatively.

The award consists of a cash prize of $100 and a percentage of the savings represented in the adoption of the suggestion, with the winner's name inscribed on a placque in the lobby of the plant.

R. Hoskin Damon, President of Bowser, Inc., is the sponsor of the award whose recipient is determined by a committee of company executives and shop personnel.

Situations Wanted

FIRST CLASS TOOL ENGINEER desires responsible position. Able to travel. Write Box U, American Society of Tool Engineers, 1666 Penobscot Bldg., Detroit 26, Mich.

* * *

HONORABLY DISCHARGED navy lieutenant seeks position in tool design or sales. Degree in physics followed by 1 year practical shop experience, 1½ years tool design for aircraft propellers and control assemblies, 3½ years navy engineering. Married. Free to travel anywhere. Write Box V, American Society of Tool Engineers, 1666 Penobscot Bldg., Detroit 26, Mich.

* * *

MECHANICAL ENGINEER with 9 years' civilian experience in tool sales, application, and design; three years in Naval Ordnance. Specialized in tungsten carbide tools and threading tools. Now Lt. Commander in Navy, available June 1st. Address inquiries to Box W, American Society of Tool Engineers, 1666 Penobscot Bldg., Detroit 26, Mich.

* * *

TOOL DESIGNER, army veteran, seeks position as Designer or Production Engineer. Four years' civilian experience in aircraft industry as Tool Designer, Tool Planner, and Die Design Group Leader; also, Instructor in Die Design for ESMWT. Background includes 3 years training in mechanical engineering. Excellent references and samples of work. Willing to go anywhere in the U. S. Address Box X, American Society of Tool Engineers, 1666 Penobscot Bldg., Detroit 26, Mich.

Nylon Pumpmaking Demands High Precision

Pontiac, Mich.—In relating the precision manufacturing methods noted during a recent trip through a nylon and rayon pump factory, T. B. Carpenter, President of the Bert Carpenter Co., Birmingham, Mich., and speaker at Pontiac Chapter's February 21st meeting, stressed the fact that these pumps must deliver to within 1/10 of a gram variation —a close tolerance.

G. F. Bryan

T. B. Carpenter

Mr. Carpenter, a Past President of ASTE, was describing his observations at W. H. Nichols and Sons, Waltham, Mass., whose slogan is "Anything almost right is wrong." Mr. Nichols, the company's founder, is assisted by his two sons, Arthur A. and W. Hart. All three are members of Boston Chapter, ASTE.

Continuing, the speaker referred to the hand milling machine made with the same careful workmanship that is characteristic of the Nichols Pumps. All milling heads, he commented, are run in before they are shipped. Mr. Carpenter, Michigan representative for the Nichols Miller, showed the new film production, "The Miller That Uses Its Head." The motion pictures illustrated many unique and practical setups, several of the installations demonstrating the new Bellows air feed attachment.

Voting for new Chapter officers resulted in the election of: Chairman, George F. Bryan; Treasurer, Lloyd W. Pardee; and Alternate, N. E. Maytag; all with Yellow Truck and Coach Div., G.M.C.; First Vice-Chairman, Harry Jeremy, Fisher Body Div., G.M.C.; Second Vice-Chairman, Claude E. Osborne, Pontiac Motor Div., G.M.C.; Secretary, Albert J. Rhodes, American Forging and Socket Co.; and Delegate, Charles F. Staples, Staple Engineering Co., Birmingham.

The dinner meeting, held in the B.P.O.E. Temple, was attended by sixty-six members and guests.

Carr Elected Vice-President

Dayton, Ohio—The election of Curtis H. Carr, as Vice-President, has been announced by the Universal Tool Company.

Mr. Carr joined the company in 1940 and has been Sales Manager for the past six years.

Formerly, he was associated with General Motors Corporation.

He is a member of Dayton Chapter, ASTE.

C. H. Carr

New officers register pleasure in their election by Flint Chapter, February 21. Seated, left to right: Norman F. Snyder, First Vice-Chairman; Lionel A. Kitchen, Chairman; and Harlan T. Pierpont, Second Vice-Chairman. Standing are: John A. Koeppen, Secretary; and Gerald H. Eggleston, Treasurer; Leon Pratt and Clyde L. Fanning, Alternate and Delegate, respectively, to the National meeting. At top, three Flint members wait for E. E. Milner's answer to a technical question. Mr. Milner, Development Engineer for Pierce-Governor Co., Anderson, Ind., spoke on the history and application of gas turbines and jet propulsion at the election night meeting in Rolly McNivens Hotel, Frankenmuth.

Discusses Engineering For Heavy Machinery

New Haven, Conn.—"Production Engineering for Heavy Machinery" was capably explained by W. E. Whittum, Production Engineer, Farrel-Birmingham Co., Ansonia, Conn., and speaker at the February 14 meeting of New Haven Chapter.

Mr. Whittum's talk included details concerning design, methods, tooling and gaging, as applied to the manufacture of heavy machinery.

He emphasized wage incentives as a means of securing cooperation between engineering and production departments, and the effect of set-up time on costs where mass production is impossible.

He also described welding and machining methods as applied to rolling mill and sugar mill machinery, rubber calenders and mixers, as well as "marine drives."

Slides showing numerous engineering charts and views of gears, gear generators, and marine drives were shown. An interesting discussion period followed, the speaker answering questions presented by the audience.

Chapter officers elected were: Chairman, Frank A. Shute; First Vice-Chairman, Ray E. Gifford; Second Vice-Chairman, Alton V. Pollard; Secretary, Floyd W. Braynard; and Treasurer, Theodore D. O'Connor.

Retiring Chairman John F. Sargent and Chairman-Elect Shute were elected Delegate and Alternate, respectively.

Details Gas Turbines In War and Peace

Flint, Mich.—E. E. Milner, Jr., of Pierce-Governor Co., Anderson, Ind., discussed gas turbines February 21st before a meeting of Flint Chapter at Rolly McNivens Hotel, Frankenmuth.

Mr. Milner reviewed the early history of gas turbines, thrust augmenters and jet propulsion. He described the application of the gas turbine to aircraft, the problems involved, and the experimental work being conducted to overcome these difficulties.

His talk included an explanation of the various types of jet-propelled warplanes used by England, Germany, the United States and other countries, and an outline of projected peacetime applications of gas turbines and jet propulsion.

Schematic drawings and sketches of engines and air frames graphically illustrated Mr. Milner's remarks. The subsequent open discussion brought out further information concerning this interesting subject.

Preceding the technical session, the members elected as '46-'47 officers: Chairman, L. A. Kitchen, Assistant Tool Supervisor, Buick Motor Co.; First Vice-Chairman, Norman Snyder, Faculty, General Motors Institute; Second Vice-Chairman, Harlan Pierpont, Abrasive Engineer, Norton Co.; Secretary, John A. Koeppen, Process Engineer, Chevrolet Motor Div., G.M.C.; and Treasurer, Gerald H. Eggleston, Tool and Die Designer, A. C. Spark Plug Co.

Clyde L. Fanning, Assistant Shop Superintendent, General Motors Institute, was elected Delegate of the National Convention, with Leon Pratt, Sales Engineer, T & H Sales, as Alternate.

Ninety members and guests were present for the dinner meeting.

Niagara District Elects New Chapter Officers

These 1946 executives of Niagara District Chapter were elected February 15 at a meeting in the Fox Head Hotel, Niagara Falls, Ont. Seated, left to right, are: Norman Coleman, Second Vice-Chairman; E. G. "Van" Dewar, Chairman; and Lloyd Sandham, First Vice-Chairman. Standing: Russell Wood, Third Vice-Chairman; E. L. Morley, Secretary; and Clifford Bradford who starts his second year as Treasurer.

Shows Internal Grinding Processes In Technicolor

Minneapolis, Minn. — "Tooling and Fixtures for Internal Grinding" was the subject Thomas D. Detherow, Field Engineer, Bryant Chucking Grinder Co., Springfield, Vt., discussed February 13, before a meeting of Twin City Chapter held at the Covered Wagon Cafe.

Mr. Detherow gave a brief introductory outline of machine tools applicable to the grinding field, particularly internal grinding. He emphasized the need of proper chucking and spindle construction to produce precision work on thin-walled parts, as well as on parts of varied contours.

Tooling Shown in Pictures

A color film presented by the speaker gave a clear and exact pictorial story of the tooling necessary to produce parts requiring internally-ground diameters, either straight, tapered or of special contours, and obtained either by traverse or plunge type grinding cut. It showed various types of chucks used for this class of grinding, including magnetic, self-centering, sliding jaw, and the diaphragm action (jaw type) chuck.

The latter type chuck is a novel and unique means of holding very thin-walled sections requiring concentric I.D., with no distortion. Ten small jaws (screw type) are actuated by the flexing of a diaphragm built into the chuck head. This equalizing of the clamping jaws assures positive holding free from distortion.

A later portion of the film was devoted to an explanation of the two-spindle (indexing type) machine, as well as contour and face grinding. The fine photography and thorough coverage of each grinding phase left little, as the speaker said, to enlarge upon, and a short question and answer period completed the technical session.

Chapter officers elected during the evening were: Chairman, John A. Harrington, President, Savage Tool Co.; First Vice-Chairman, Clifford V. Lofdahl, Tool Designer; Secretary and Treasurer, Harold D. Sullivan, Tool Designer; and Delegate, George W. Wise, Chief Tool Designer, all of Minneapolis-Honeywell Regulator Co., and Second Vice-Chairman, Raymond L. Martin, Sales Engineer, Northern Machinery and Supply Co.

* * *

"How smooth is smooth," has been a catch question among tool engineers, inspectors, lathe and grinding operators for a number of years and still was for many members and guests present at a recent Chapter meeting. Dr. Ernest J. Abbott, Technical Director of Physicists Research Company, Ann Arbor, Mich., answered this question with an excellent lecture on "Surface Roughness Measurement and the Profilometer," plus a dash of showmanship.

Dr. E. J. Abbott

Dr. Abbott introduced his talk with a review of the need for some positive means of noting surface roughness, particularly during World War II, and the necessity of having this information on process sheets and drawings. Another requisite was a quick and convenient method—under shop conditions (not laboratory)—to determine by a standard unit of measure the surface roughness of a work part. It was through research and development by Dr. Abbott and his associates that the "Profilometer" was introduced in response to requests from large manufacturers for equipment of this nature.

During the past four years the "Profilometer" has made a valuable contribution to the war effort. To show that industry recognized the practical need for this equipment, Dr. Abbott displayed a year-by-year sales chart. His dramatic use of these charts entertained the group, especially when the 1945 record made it necessary for him to paper the ceiling to show the peak of that year's production.

In conclusion the speaker made a machine demonstration on sample parts, followed by a question and answer period.

During the business meeting Chairman Wallace Ahlbert presented William Boaker with a Past Chairman pin. Mr. Boaker expressed his appreciation of the gift, remarking that he considered his ASTE membership a most valuable educational opportunity and assuring the members of his continued participation in Chapter activities.

Multiple Cavity Dies Cast 6000 Pieces Hourly

Schenectady, N. Y. — C. R. Maxon, Development Engineer for the New Jersey Die Casting Company, conducted the technical program at the February 14 meeting of Schenectady Chapter in Endries Willowbrook Golf Club, Glenville.

Mr. Maxon's presentation consisted of a technicolor sound film describing accurately and informatively the process of die casting.

The motion pictures showed a molten metal, about 95% zinc alloyed with aluminum, copper, magnesium, iron, lead, cadmium and tin, being extruded from a pneumatically-operated cylinder, and forced into a closed die.

As the filled die was opened, a system of built-in ejector pins pushed out the finished casting. Die castings, Mr. Maxon said, range in size from a single zipper tooth to the entire housing of a candy vending machine. Medium-sized castings can be turned out at the rate of 300 an hour in single cavity dies, while multiple cavity dies might make as many as 6000 pieces an hour.

At the conclusion of the film, Mr. Maxon answered many questions.

Winners in the annual election of officers, preceding the technical session, were: Chairman, D. M. Schiele; First Vice-Chairman, John Stedman; Second Vice-Chairman, E. J. Smith; Third Vice-Chairman, Fred Kinum; Treasurer, R. H. Wilke; and Secretary, A. E. Lee.

Forty members and guests attended the dinner meeting. Visitors included Harry Levinson of Seattle Chapter.

300 See Installation

Baltimore, Md.—Installation of Baltimore Chapter officers, held March 1st in the main ballroom of the Lord Baltimore Hotel, was witnessed by 300 members and guests, including forty visitors from Potomac Chapter.

W. D. Winger

Those inducted into office for the coming year were: Chairman, W. Daryl Winger; First Vice-Chairman, Kurt H. George; Second Vice-Chairman, Thomas Burke; Secretary, Harold C. Suiter; and Treasurer, Clarence Hand.

Arrangements for the dinner party were under the direction of Membership Chairman Godfrey F. Steiner.

Engineer-Author Joins Die Casting Concern

Brooklyn, N. Y.—Fred J. Tobias, internationally-known as a research and metallurgical engineer, author and patentee, has joined Advance Pressure Castings, Inc., to take charge of production and metallurgy.

F. J. Tobias

Mr. Tobias was born in Czechoslovakia and educated in Austria, Moravia, and at Yale University, New Haven, Conn. He holds a B.S. degree in M.E.

In this country he has been employed by a number of organizations, including Newton Die Casting Corp., Sylvania Industrial Corp., Graphitized Alloys Corp., and Powder Metallurgy, Inc.

Much of his time has been devoted to research and the solving of definite problems in connection with new developments. He has written many papers and books, among them "Lead Base and Tin Alloys for Die Castings," "Recent Die Casting Developments," and "Influence of Casting Practice on Physical Properties of Die Castings." He has also lectured extensively before many technical societies.

Mr. Tobias is a member of the American Society for Testing Materials, American Institute of Mining and Metallurgical Engineering, American Society for Metals, American Foundrymen's Association, and ASTE.

Plastics Engineer Explains Tooling

Cedar Rapids, Iowa—Officers' reports of the year's activities and progress preceded Cedar Rapids' annual election of Chapter officers at a dinner meeting and technical session, February 20, in the Chamber of Commerce Building.

In the balloting for new officers, Michael Fitzgerald was elected Chairman; Robert Hruska, First Vice-Chairman; and Ray Bextine, Second Vice-Chairman. John Stark was re-elected Secretary and E. O. Spangler succeeds Mr. Hruska in the office of Treasurer.

The retiring Chairman, John Speck, was chosen Chapter Delegate to the National convention, with the incoming Chairman, Mr. Fitzgerald, as Alternate.

Principal speaker was H. R. Husted, Technical Service Engineer for the Celanese Plastics Corporation, Chicago. He discussed types of plastics, applications, tooling, and the manufacture of plastic parts. He also presented to the 39 members and 25 guests an exceptional color film on plastics, entitled, "The Shape of Things to Come," filmed in the plant of the Boonton Moulding Company.

Youngest Chapter Holds Annual Election

Aurora, Ill.—Fox River Valley Chapter held its annual election of officers, February 26th, at Hotel Baker, St. Charles, Ill.

Dinner, served in the beautiful Rainbow Room, preceded the voting for new Chapter executives. Candidates elected were: H. J. Braun, Chairman; G. M. Waller, First Vice-Chairman; R. G. Frogness, Second Vice-Chairman; T. L. Kings, Secretary; and B. J. Phillips, Treasurer.

Instead of the usual technical session, W. Becker, "Man of Mystery," entertained with legerdemain. Mr. Becker also performed the famous Houdini chain trick, allowing himself to be chained to a chair by two of the engineers who did a scientific job of tying him up. At a given signal the illusionist was covered with a black cloth from which he emerged eight seconds later free of his bonds.

Fox River Valley is the 72nd and most recently admitted Chapter of the Society, having been chartered last summer.

Top Office Goes to Seely

Rochester, N. Y.—On February 21, Rochester Chapter held their annual election to name new officers and a Chapter Executive Board. Approximately 125 members attended the meeting at Eagles' Hall.

Past Chairman Chauncey Newton, as head teller, announced the results of the voting as follows: Chairman, Charles Seely; First Vice-Chairman, Milton Roessel; Second Vice-Chairman, Herbert Simon; Third Vice-Chairman, William Gordon; Secretary, Martin Ness; and Treasurer, Fred Bittner; Executive Board members—George Codd, Donald Kohler, and Earl Roller.

Chairman Earle DeBisschop was elected Chapter Delegate with Past Chairman Chauncey Newton as Alternate.

Members recently released from the Armed Forces were recognized and thanked for their efforts while in military service, by Chairman DeBisschop. Those honored were Ford Sears, Fred Buehler, Carl Buehler, Joseph Kleeh, Bertram Pemberton, and Frank Mason.

Tool Salvage Expert To Form New Company

Detroit, Mich.—Larry W. Lang, former Vice-President and Sales Engineer of the National Tool Salvage Co., Detroit, has announced his resignation from that company.

L. W. Lang

A member of Detroit Chapter, ASTE, Mr. Lang has been active in Society affairs for many years. He has addressed technical sessions at two national conventions and numerous Chapter meetings, as well as an ASME national assembly and several WPB regional conferences.

Mr. Lang and some of the members of his former staff are forming a new company which will operate in the perishable tool field.

Rochester Chapter members visit while awaiting the outcome of balloting for Chapter officers at February 21st meeting in Eagles Hall. Among those shown in the two general views are Past Chairmen Cecil Lucas and Clifford Sears; Treasurer Fred Bittner, Arno Ziedler, Raymond Hall, George Hassleberg, Russell Howard, Ernest Straw and James Horne, Jr. Reflection in mirror is of Public Relations Chairman Robert Barnett. Happy to be back from the wars are, top left to right: Ford Sears, Fred and Carl Buehler, Joseph Kleeh, Bertram Pemberton and Frank Mason. The ASTE ex-servicemen were formally welcomed at the February meeting.

BULLETINS AND TRADE LITERATURE

Items briefed herein have been carefully selected for their interest and application. Unless otherwise stated, all are available, free, from the stated sources.

Bulletin No. J-1, by **REPUBLIC DRILL & TOOL CO.**, Chicago, features a reprint of an article—"Speed and Precision with Hyper Drilling"—by Karl Stad in the July '45 issue of THE TOOL ENGINEER. The Bulletin points out the speed and precision, in mass production, made possible by the use of the Republic *Jet Drill* and *Jet Director*. The system, which employs a novel drill and bushing design, with coolant jet under high pressure, permits of unusually high spindle speeds and feeds.

Two articles—"Oil Purification has come a Long Way" and "Research is Key to Future Progress," in Volume 2, No. 1 of *Clean Oil*, deal with development in oil purification and present day applications in industry. In the same issue is an announcement of four new products—two sump cleaners and two coolant filters. Copies are available from **HONAN-CRANE CORPORATION**, 676 Wabash Ave., Lebanon, Indiana.

ZAGAR TOOL, INC., 23880 Lakeland Blvd., Cleveland 17, Ohio, has issued a 28-page booklet illustrating *Zagar Tooling* for milling, drilling, tapping, grinding, slotting, turning and broaching. Included in the booklet is a reprint article from THE TOOL ENGINEER, which tells the story of the Zagars and their early expansion problems. The article, "Tool Making to Simplified Broaching," by Rex Heath, was originally published in the Sept., '45, THE TOOL ENGINEER.

The Intent of Congress, a 14-page booklet by the **NATIONAL TOOL & DIE MFGS. ASS'N** and the **TOOL & DIE INSTITUTE** of Chicago, is a protest against Section 722, of the Internal Revenue Code, which was originally intended as a relief measure. On behalf of some 4,000 tool and die shops, the essential facts were submitted at governmental hearings in Washington. According to Mr. George S. Eaton, Executive Secretary of the NTDMA, a marked improvement is hoped for as a result of this protest.

Water-Mixed Cutting Fluids is a 24-page booklet by **D. A. STUART OIL CO., LIM.**, 2727 S. Troy St., Chicago 23. Containing much information for users of so-called "soluble oils," it also has articles on hygiene and design data for cutting fluid systems.

Metal Marking Equipment for Industry, the most recent catalogue of **WM. A. FORCE & CO.**, 216 Nickols Ave., Brooklyn 8, N. Y., illustrates their assortment of hand and power presses with numbering heads, knurling equipment, steel stamps and dies, and marking equipment accessories.

J. GORDON LIPPINCOTT & CO., New York and Chicago industrial designers, has prepared a bound portfolio on applications of industrial design. The literature includes examples of designer-client mutual publicity, outlines of Industrial Design as a profession, pamphlets on Packaging, Interiors, Lighting, Product Development, Style Obsolescence, Emotion vs. Intellect in Product Merchandising, and a folio on costs of Industrial Design. Copies, available upon request, from 500 Fifth Ave., New York 18.

New looseleaf *Blue Sheets* of reference data are available from the **ALLEGHENY LUDLUM STEEL CORP'N**, Brackenridge, Pa. There are pages on Allegheny stainless steel castings, stainless steels Type 347, 321 and 416, and on Ludlum 609 shock resisting steel for tools and machine parts. Physical properties, corrosion and oxidation resistance, and effects of elevated temperature and heat treating are given in condensed form for quick reference.

PATENT SPECIALTIES, INC., 4020 10th Ave., New York 34, has issued a folder on their *Magic Wand Welder*. This portable welding outfit, weighing less than 30 pounds, can be plugged into any standard underwriter-approved 110 volt, 60 cycle, A.C. outlet.

A new catalogue—*Inserted Blade Cutters*—by **MIDWEST TOOL & MFG. CO.**, 2360 W. Jefferson Ave., Detroit 16, describes and illustrates the Midwest line of inserted blade cutters, special tools and their applications. This 24-page catalogue includes all necessary tabular data as to sizes and kinds of cutters available, as well as several pages on sharpening and adjusting.

An improved *Flexible-Power Press* is described in bulletin 381 of the **GENERAL MFG. CO.**, Detroit 11. This 15-ton capacity press is adaptable for use in production straightening, assembling, staking, forcing, pressing in gears, bending, burnishing, riveting, push broaching, and pressing in armature shafts.

Riveting Machines, a six-page bulletin of **THE H. P. TOWNSEND MFG. CO.**, Hartford 1, Conn., shows their line of machines for handling almost every type of riveting process from heavy metals to the riveting of eyeglass frames.

BOYAR-SCHULTZ CORP'N, 2110 Walnut St., Chicago 12, has issued a looseleaf bulletin paeg on *SMB T-Slot Bolts*. Made from tough, heat treated alloy steel, these bolts present a clean, flat bearing surface to the upper side of the T-Slot.

A Standard Stock Cone-Drive Gear Sets catalogue, released by **MICHIGAN TOOL CO.**, 7171 E. McNichols, Detroit 12, provides quick selection of size and ratio of gear best suited to each specific power transmission requirement. It includes gear sets ranging from a center distance of 2" to 18" and in ratios from 5:1 to 70:1, varying from .06 h.p. at 100 r.p.m. to 800 h.p. at 2400 r.p.m. All are based on Class 1 service.

The *10th Anniversary Catalogue*, by **NOX-RUST CHEMICAL CORP'N**, 2423-63 S. Halsted St., Chicago 8, lists 17 types of rust preventatives, protected coatings and related industrial chemicals.

Three loose-leaf bulletins—*Nos. 321-A, 322 and 323*—by **BALDOR ELECTRIC CO.**, 4357 Duncan Ave., St. Louis 10, Mo., illustrate several of their ball bearing grinders from ¼ to 3 h.p., a ½ h.p. carbide tool grinder and several general purpose motors from ⅙ to 20 h.p.

BAILEY METER CO., 1050 Ivanhoe Rd., Cleveland 10, Ohio, has issued a bulletin called *Bailey Duplicating Attachment for Machine Tools*. It illustrates their combined air and hydraulic system which may be attached to engine or turret lathes, and to vertical boring mills, to produce work pieces with contours exactly corresponding to thin master templets.

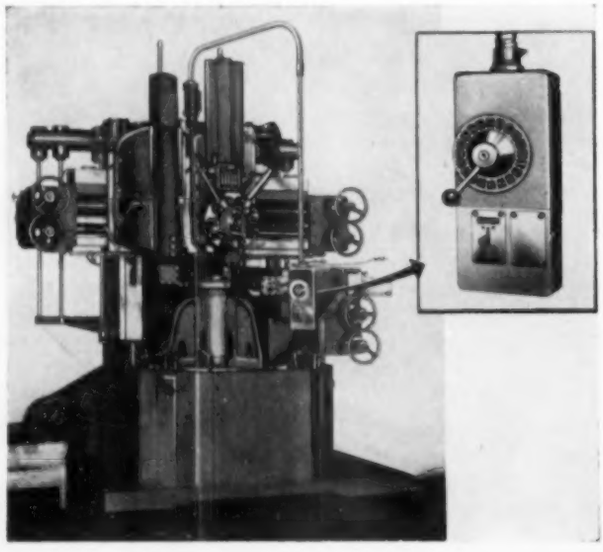
TOOLS OF TODAY

Pendant Control for Bullards

PENDANT CONTROL, a unique and exclusive feature of all Bullard Cut Master Vertical Turret Lathes, manufactured by the *Bullard Company*, Bridgeport, Conn., provides a high degree of control and operating efficiency. A swinging arm, carrying the pendant, which is located at a convenient operating height, is mounted on the machine high enough to permit full clearance of vertical heads when they are in maximum high position. The arm may be swung from right to left of the machine to any convenient point, thereby giving full control at all times.

The design is a departure from conventional controls, of this type, in that speeds are selected very rapidly by means of dialing. When, with the machine in operation, a change of speed is desired, the switch lever is thrown into brake position. Speed change is then dialed, and the lever thrown back into clutch position. Gears are shifted, quietly and almost instantaneously, through electrically-controlled, hydraulically-operated mechanisms. Gear selection is insured by a self-interlocking design.

Jogging of the table, for positioning and indicating, is easily accomplished through the use of the switch lever. This will jog and position the table for any fraction of a revolution. The Pendant Control, of which full details may be had from the Bullard Company, enhances the performance of a machine already reputed for its high efficiency.



Carbide Tipped Drill Bit

The New England Carbide Tool Co., 60 Brookline St., Cambridge 39, Mass., announces a **CARBIDE TIPPED DRILL BIT** for faster, cleaner, more accurate drilling in masonry and metals. Produced for use in ordinary rotary electric drills, the bits come in sizes $\frac{3}{16}$" to $1\frac{1}{2}$" by sixteenths. In drilling holes in masonry, chilled iron, aluminum, cast iron and other non-ferrous materials the drill may run hot but will not lose its cutting edge because of the hard carbide tip. Bulletin available.

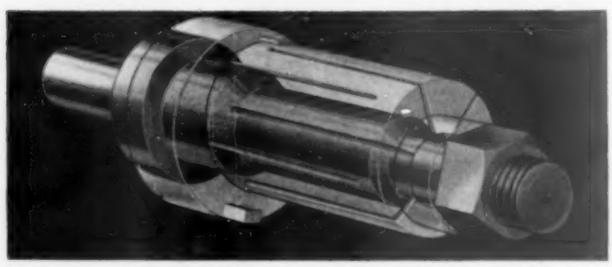
New Safety Device for Shapers

THE FUNCTION of the safety device, **LUBRIGARD**, manufactured by the *General Engineering & Mfg. Co.*, St. Louis 4, Mo., is to automatically prevent the ram of the shaper from being started under one or more of the following conditions: In case oil supply in reservoir is insufficient; if pressure in the system be below the minimum required; should a leak or failure of the oil pressure system occur; if the filter becomes clogged; should the drive pulley rotation be incorrect.

In addition, Lubrigard will prevent the clutch control lever from being engaged while the drive pulley is at rest. Therefore, should the motor be started, the ram will not move unexpectedly.

New Expanding Mandrel

A NEW TYPE **EXPANDING MANDREL** with eccentric sleeve, manufactured by the *Erickson Steel Co.*, 2309 Hamilton Ave., Cleveland, eliminates the use of arbor presses and special arbors and holds the limits of the ground or machined eccentric parts within .0005". The shank is standard, and all that is required is a special sleeve.



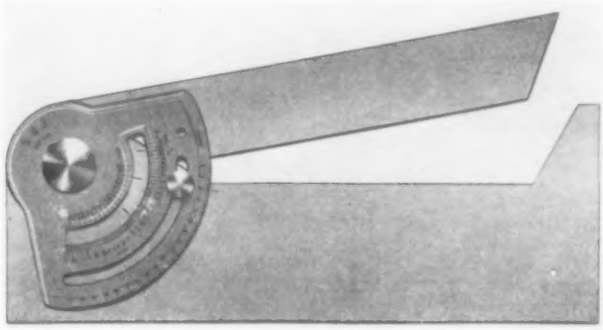
P&W Air-O-Limit Comparator

FOR HAND GAGING at a distance from the Comparator (shown in lower foreground) *Pratt & Whitney*, Division Niles-Bement-Pond Co., West Hartford, Conn., has brought out the Model R2 **AIR-O-LIMIT COMPARATOR** with Booster Relay.

The latter permits the use of any length hose between the gage cabinet and the gage plug, for remote gaging, without loss of speed or accuracy in the gaging operation.

New Tool for Draftsmen

A NEW PLASTIC drafting tool, called the **S&J QUADRANGLE**, is offered by the *Instrument Company*, Bartlett Building, Los Angeles 14, Calif. Angles from 0° to 90°, pitch scales from 0 to 24/12, percentage slopes from 0% to 100%, and sines, cosines, and tangents may be found with the S&J Quadrangle. This instrument has eight drawing edges, is rectangular in shape, and may be used as a triangle.

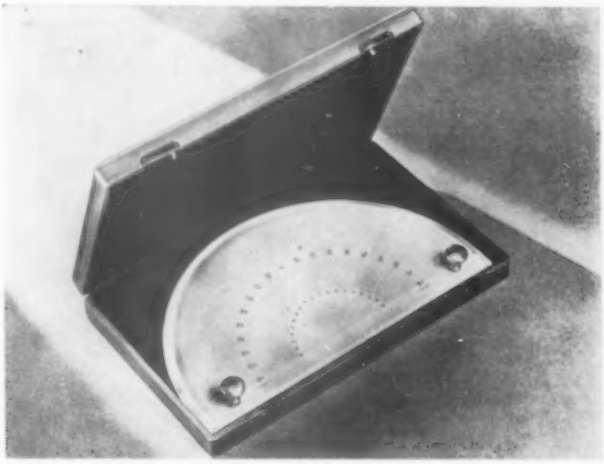


Precision Level

THE **FELL PRECISION LEVEL**, with graduations of .0005 inch per foot, is designed by *Wm. B. Fell Co.*, Rockford, Ill., for machine tool industry and maintenance. It is made in two standard sizes, type B being 3½" x 6".

New Layout Protractor

A NEW **LAYOUT PROTRACTOR**, made of glass and with the circular edge beveled to a thin outer edge through which the divisions are viewed, is offered by *The Universal Engraving & Colorplate Co., Inc.*, 980 Ellicott St., Buffalo 8, N. Y. A leaflet describing this device is available.

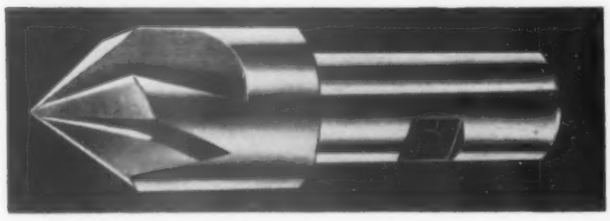


Safer Cut-Off Wheels

NEW WHEELS, incorporating abrasive in a cotton fibre bonding, are made by the *Bay State Abrasive Products Co.*, 21 Union St., Westboro, Mass., for cut-off wheels for non-ferrous metals. These **BAYFLEX WHEELS** combine greater safety with faster, freer cutting action and minimizing the operator's fear of wheel breakage. Increased toughness, and balanced flexibility of an entirely new bonding material, makes for greater safety and faster cutting, while their improved flexibility permits side grinding and close following of contours.

Chatterless Countersink

A NEW **COUNTERSINK** with a balanced cutting action, reducing "chatter" to a minimum, is made by *The Tru-Cut Tool Co.*, Detroit. Tru-Cut countersinks are available in standard angles of 60, 82 and 90 degrees, in sizes from ¼ to 2 inches.

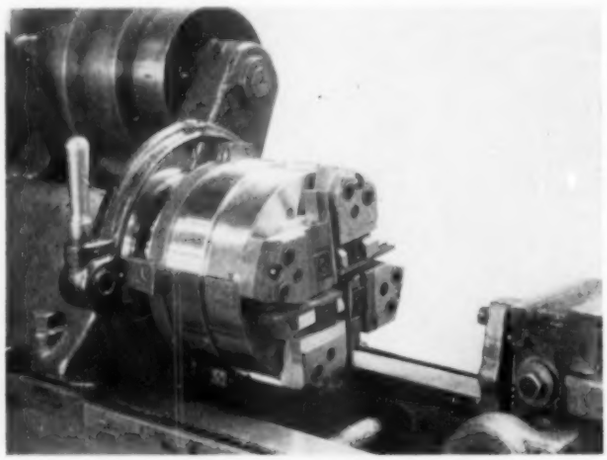


Hardened and Ground Die Heads

The Landis Machine Company, Waynesboro, Pa., has available a new series of Lanco **DIE HEADS.** The new series, identified as the Type VV, is available in the 1", 1½", 2" and 2½" sizes for use on hand operated threading machines. These heads are especially recommended for threading alloy steel and for work which must be held to extremely close tolerances.

The Type VV Lanco Die Heads have all parts made from special alloy steel, precision ground to assure maximum accuracy.

The chaser holders are clamped to slides of heavy cross section, to assure maximum rigidity. The manner of clamping permits the removal of the holders from the face of the head, for interchange, without disassembling any part of the head or removing the head from the spindle.



Bench Combination Machine

Parlee Tool Company, 919 E. Redondo Blvd., Inglewood, Calif., is manufacturing a compact, and inexpensive **COMBINATION TOOL**—power grinder, sander, buffer, and saw. The saw table permits the use of Dado heads and may be used for routing. A moveable plate slides away from the cutter, and a fixture is attached to the table edge in the mounting. A folder is available.

New Explosive Rivet Iron

The *Ripley Company* of Torrington, Conn., announced the acquisition of all Goodyear rights to the **LOW VOLTAGE RIVETING IRON** used for setting Deu Pont Explosive Rivets, which are widely used in blind applications and hard-to-reach places.

The No. 6 Riveting Iron is designed so that upon the pressure of a trigger electric currently instantly produces intensive heat at the point of contact with the rivet head. The head detonates the expansion charge within the rivet shank, forming a strong, tight joint.

New Kennamill Cutter

Kennametal Inc. of Latrobe, Pa., has developed a new type of **MILLING CUTTER** called the "Universal" Face Kennamill, which consists of a precision built heat treated steel body, or tool holder, with a set of detachable solid Kennametal blades mechanically held in position.

Five standard sizes are now available—4", 6", 8", 10", and 12" diameter. Blades for these are of the same cross section, and when shortened by regrinding, can be used in smaller cutters successively. They are "formed" at both ends, and can be used in either right or left hand cutters.

The Face Mill can be adapted for milling different materials simply by interchanging blades. Those having the proper grade of carbide and suitable cutting angles are selected and inserted.

Shock Absorber For Lathes

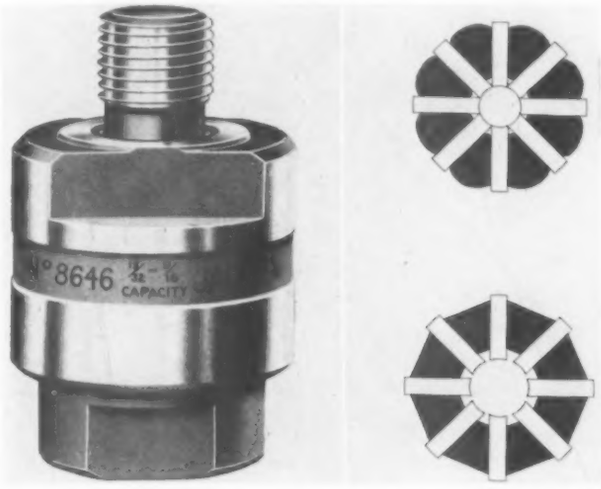
A NEW absorption device—trade name **VIBRA-DRIVE**—is being manufactured by *The Drafto Corporation*, Cochranton, Pa. The device is attached to the face plate of a lathe or grinder with the tail of the dog in direct contact with the absorber pad. This pad absorbs shocks caused by cutting tools, and vibrations set up by machine driving mechanism. Slots in the absorption device base are designed so that the driver may be located in the most advantageous position on the face plate. Five sizes cover a range from 6" to 72" swing on lathes and grinders.

New Pneumatic Screwdriver

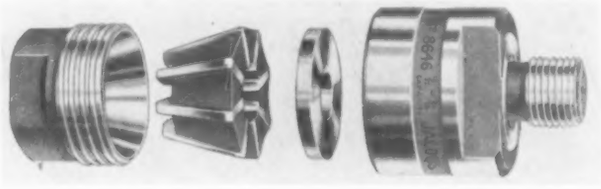
A MIDGET air-operated **SCREW DRIVER**, by *The Aro Equipment Corp'n*, Bryan, O., takes No. 1 to No. 6 screws, weighs 8 ounces and is 4⅞" x ¾" in diameter. It starts automatically when the tool is applied to the work and adjusts itself to every driving condition. It has rotary type, four blade construction motor, ball bearings throughout, with hardened and ground steel rotor and cylinder. Air consumption is negligible and the tool is considered to be foolproof in operation.

New Type Drill Chuck

A RADICALLY NEW TYPE of heavy duty drill chuck, in which a tough web of neoprene synthetic rubber keeps the jaws in better alignment and permits one chuck to take a wider range of drill sizes, has been developed by *The Jacobs Manufacturing Co.*, of Hartford, Conn.

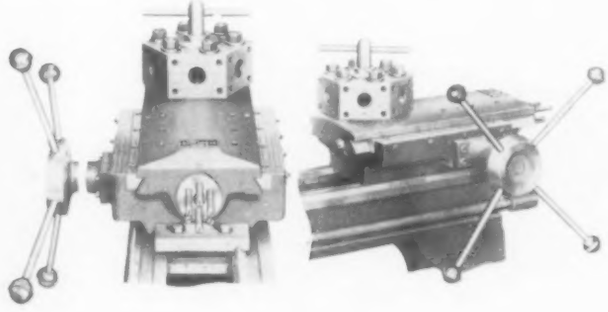


In its function, the resilient material replaces the flexible spring steel collet shank of the traditional single purpose drill chuck. The rubber is bonded to the steel jaws and passes through anchoring holes in them, a design which makes the collet or inner socket of the chuck a compact, conical unit. The "Rubber-Flex Collet," as it has been named, is tightened by a screw mechanism which forces it forward into the smooth funnel-shaped nose of the chuck. As soon as the chuck is loosened for changing drills the neoprene web pushes the jaws apart and releases the drill shank.



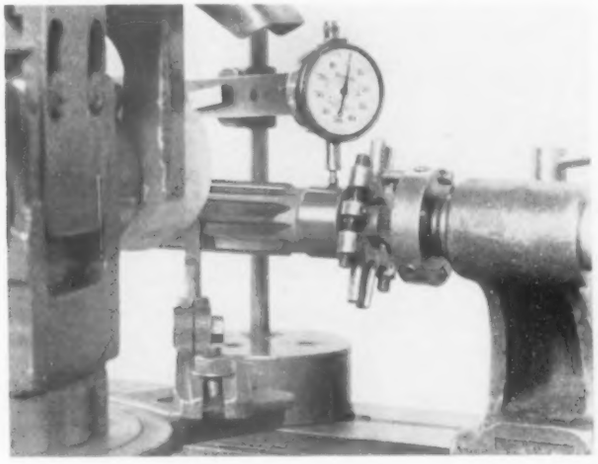
Bed Turret With Double Drive

A NEW BED TURRET for lathes up to 14" swing has been announced by *Enco Manufacturing Co.*, of Chicago. Known as the **HEXTURRET**, it uses double drive gears and double racks for equalizing the feed of the tool on the work. This twin drive also keeps the turret in perfect alignment and minimizes wear. Double gibs of the heavy duty type are employed to maintain constant accuracy providing for an adjustment from either the front or back dovetail. Literature is obtainable.



New Floating Center

A FLOATING TYPE **CENTER**, for sharpening expansion hand reamers, by the *Norton Co.*, Worcester 6, Mass., solves an old shop problem. The procedure is to first adjust the expansion plug of the reamer so that the highest micrometer reading, obtainable, is from .002" to .004" over the nominal size. The reamer, with the setting of the expansion plug undisturbed, is then placed between centers on a universal tool grinder. The tail center, being a floating type, permits centering the front pilot surface with an indicator, when the reamer may be ground concentric with the pilot.



New Gage Kit

A NEW *GAGE KIT*, trade name "Producto-Chek," is designed for production checking and is offered by the *DoAll Co.*, Minneapolis, Minn. It consists of a number of instruments to be used in conjunction with gage blocks for quickly setting up practically any type of inspection gage. Two of the unusual tools are an indicating snap gage and an internal gage, both incorporating dial indicators. Then, there is an angle comparator using two dial indicators, which is set with a sine bar. When an angle, identical to that of the sine bar setup is checked, the dials read alike. Included also in the kit, is a multiple bench comparator that makes two measurements simultaneously, permitting increased speed in production checking. Another outstanding instrument of the kit is an indicating square check gage. With this, the work is placed on a master flat and is simply pushed against a back stop, a dial indicator showing instantly whether or not the angle is 90 degrees. It is claimed that the "Producto-Chek" kit will actually do the work of more than a million separate gages with gage block accuracy.

North East West South in Industry

A. L. ATHERTON has been appointed advisory engineer, and **FRED C. HEYL** manager of the Quality Control Department, East Springfield (Mass.) plant of the *Westinghouse Electric Corporation*. The announcement is made by J. R. Weaver, works manager of the Springfield plant.

HENNING FREDEN has joined the Detroit College of Applied Science as instructor in Tool Engineering, Design and kindred subjects. A graduate of Chalmers Inst. of Eng'g, Gothenburg, and broadly experienced in modern mass production techniques, Mr. Freden brings to his new position many years of experience as plant and engineering executive.

The **A. C. HABERKORN MACHINERY COMPANY**, 412 New Center Bldg., Detroit, of which past A.S.T.E. Director Wm. Mauer is a partner, has been appointed distributor, Detroit Area, for the *Denison Engineering Company*, Columbus, Ohio. The Detroit office, with which A.S.T.E.'ers Jos. Siegel (past president) and C. T. Michelsen, are connected will handle the Multipress, as well as hydraulic presses and accessories manufactured by Denison.

As announced by J. W. Corey, president, **FRED E. HARRELL**, general wks. mgr. of *The Reliance Electric & Eng'g Co.*, Cleveland, was elected a Director at the annual meeting of stockholders. With Reliance since he was graduated from Purdue, in '24, Mr. Harrell became chief engineer of the company in 1943 and general works manager in 1945.

A. Milne & Co., steel distributors, has transferred **COURTLAND W. SCHEFER** from their New York office, to take charge of the new Rochester, N. Y., branch, located at 703 Temple Bldg. **JOHN I. KITTS**, previously sales representative in Duluth, is in charge of the new St. Louis office at 411 N. 7th St. **W. F. GOETZ** has been appointed manager of the Pittsburgh office, succeeding **H. L. BODWELL**, retired. Manager of the Boston office is **D. T. HADDOCK**, transferred from Washington. **F. G. GRANT** remains as branch manager of Eastern New England sales for Milne.

ALLEN-BRADLEY CO., Milwaukee, recently appointed Muth-Richards, 1426 Broadway, Seattle 22, Wash., as its new representative in the Seattle area.

The Muth-Richards Co. will render a complete Sales engineering service on Allen-Bradley motor controls.

MULTI-MATIC ACCOUNTING has been developed by *Remington-Rand* for small and medium businesses and branch office accounting in large organizations. Invented by Rolf Hurup, member of the Nat'l Ass'n of Cost Accountants and of the Scandinavian Eng'g Soc'y, the basic principle of the system is the simultaneous posting of a number of financial or statistical reports, by means of a single writing, in several different columns on separate reports. Tested by selected companies, the system is said to effect savings of 40% in cost and up to 66% in time.

The Order of Merit, highest honor conferred on its employees by *Westinghouse Electric Corp'n*, has been presented to **Lott Steffey**, veteran of 38 years, for distinguished service to the Electrical Industry. Mr. Steffey was cited for "his stability and untiring effort . . . and for his skill as supervisor of diversified departments requiring highly specialized machining and tools."

J. W. BRAUNS has been appointed Manager of General Electric's Industrial Haulage Division. He succeeds F. H. Craton, now Ass't Mgr. of the Transp. Div. His main responsibility will be the sale, application, and servicing of industrial locomotives, including Diesel-electric and electric mine locomotives and electric equipments for these locomotives.

A. W. KREMSER has been named Branch manager of the Davenport, Ia., office of the *Allis-Chalmers Mfg. Co.*, Milwaukee. He succeeds C. J. Schutty, who is being transferred to the company's Kansas City office.

RAY MORRISSEY has joined *The Cross Co.*, Detroit, as Vice-President in charge of Sales. Associated with the Cincinnati Milling Machine Co. for twenty-nine years as factory representative and eastern district manager, Mr. Morrissey brings to his new affiliation wide experience in recommending and applying shop practices for machine tools.

CARBOLOY CO., INC., Detroit, has appointed **A. F. Dobbrodt**, formerly Pittsburgh General Manager, as Special Products Engineer to head a new division of that name in the company's General Sales Department.

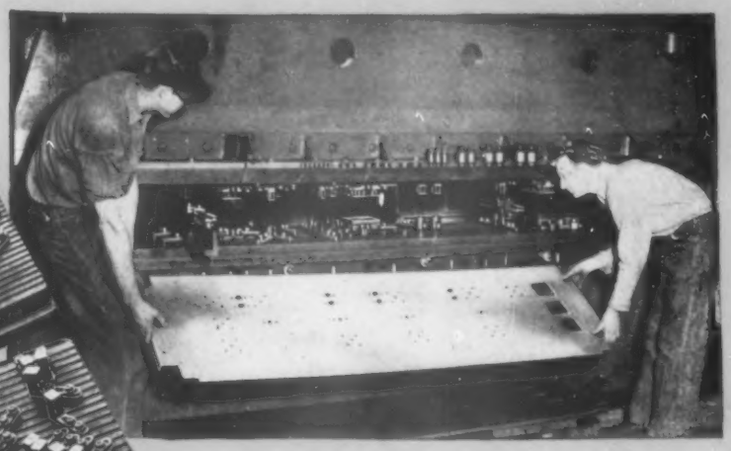
Other personnel changes involve **F. J. Staroba**, formerly in Milwaukee; **R. B. Lewis**, previously Service Engineer at the home office, and **E. Monacelli**, who was located in St. Louis—all transferred to the Chicago office. C. W. Powell, of the General Sales Department, has been assigned to St. Louis.

JAMES WHITE was recently appointed Controller of Materials for *The Tomkins-Johnson Co.*, Jackson, Mich., manufacturers of air and hydraulic appliances, riveters and die sinking cutters.

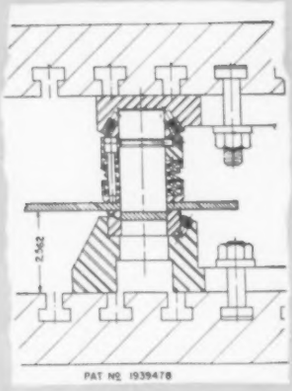
H. D. MORELAND has been recently appointed as manager of the *Westinghouse X-Ray Div.*, Baltimore. He succeeds A. P. Craig, who will assume important duties with the Westinghouse Canadian Company. Mr. Moreland received his B.S. in Electrical Eng'g at Oregon State College in 1930 and his M.S. from the same institution two years later.

The **PRODUCTS OF TOMORROW EXPOSITION**, scheduled to open at the Chicago Coliseum April 27th, has been indefinitely postponed.

Typical 3 section set-up of Whistler multi-use punch and die units.



An example of piercing standard size holes, special shapes and corner notching with Whistler adjustable dies.



Sectional drawing illustrating simplicity of assembly of punch and die unit parts.

PIERCE 1/4" STEEL WITH WHISTLER MULTI-USE ADJUSTABLE DIES

Here's another production time and money saving advantage from Whistler. Now you can use the SX series of heavy duty adjustable dies for piercing materials up to and including ¼" steel.

Punches and dies are available from stock in all standard sizes from ⅛" to 3" diameters. No time lost in getting into production. Absolute precision on short or long runs. Rearrange the same units... combine with notching, special shape or group dies if called for... and go right ahead on the next job. Whistler adjustable dies have unlimited use and pay for themselves over and over. Work in practically any type press and ordinary skilled workers can make set-up changes.

Whistler Adjustable Dies are being used by the top names in industry everywhere... there are reasons aplenty. Tell us about *your* piercing problems. Send blueprints. No obligation in finding out why Whistler Adjustable Dies should be working in *your* plant.

S. B. WHISTLER & SONS, INC.
752-756 MILITARY ROAD BUFFALO 17, NEW YORK

THE LANDIS 3/8" THREADING MACHINE

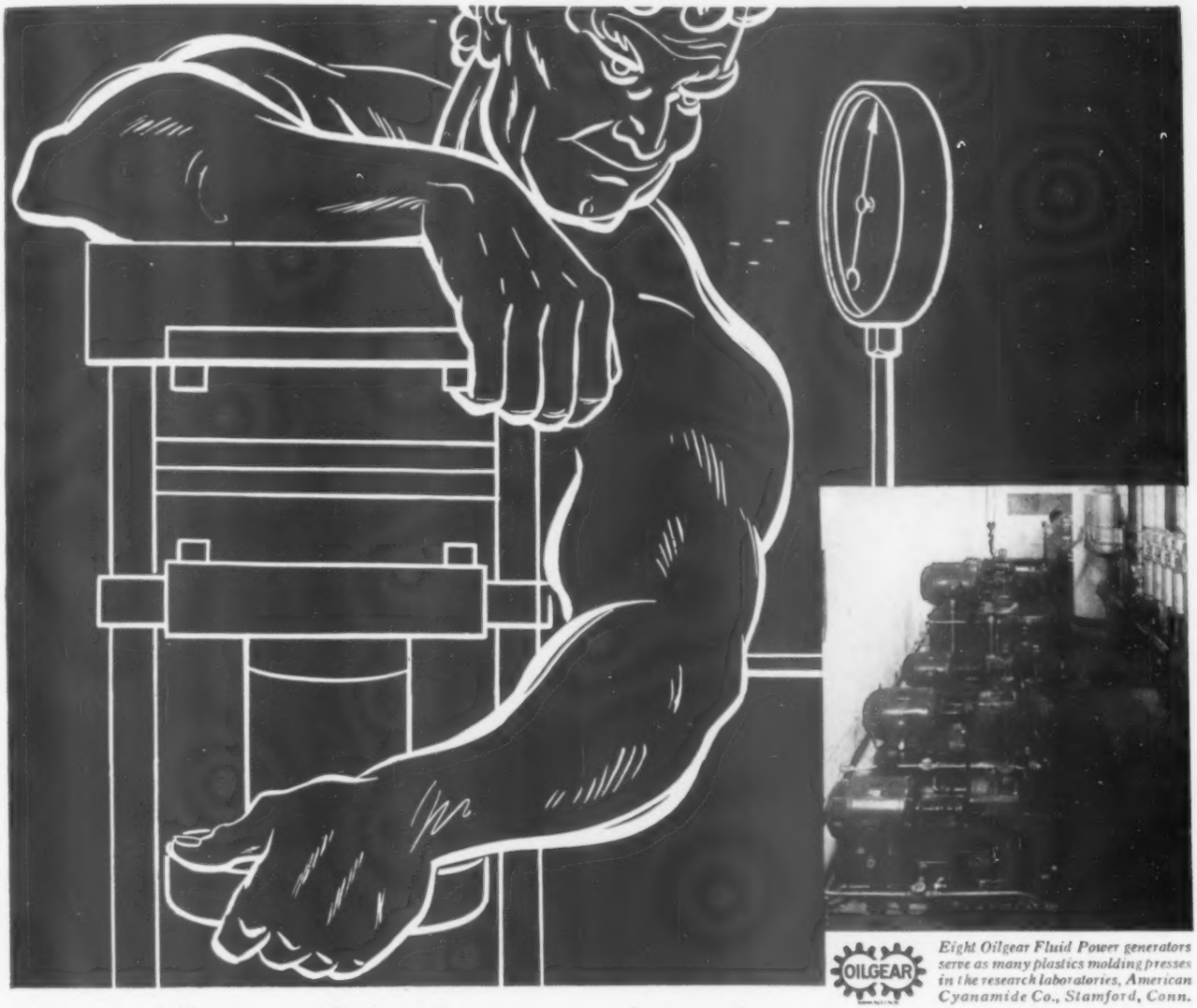
... for Speed and Economy

Manufacturers of small parts find the 3/8" LANDIS (High Speed) Threading Machine ideal for handling their work. The high spindle speeds and simplicity of operation, with one lever controlling both the movements of the carriage and the opening of the grips, assure unusual production possibilities. The machine illustrated is producing over a thousand 5/16" diameter studs, 5/8" long, per hour. Several thousand threads are produced per grind of the chasers.

Write for Bulletin No. H-91

LANDIS MACHINE COMPANY, WAYNESBORO, PENNA, U.S.A.

THREAD CUTTING MACHINES • DIE HEADS • COLLAPSIBLE TAPS • THREAD GRINDERS



Eight Oilgear Fluid Power generators serve as many plastics molding presses in the research laboratories, American Cyanamide Co., Stamford, Conn.

Here, Oilgear Fluid Power points the way to better plastics products

Can precision control of power help you in experimental, design or production work?

There apparently is no end to the ways in which versatile Oilgear Fluid Power can help industry turn out better products. In the Stamford, Conn., Research Laboratories of the American Cyanamide Company for example, Oilgear's smooth, infinitely variable and precisely controllable power and speed are helping plastics research fully to investigate and compare the characteristics of various plastics throughout the full pressure range.

One of many desirable press cycles possible with Oilgear Fluid Power is: quick closing of platen a preset distance . . . maintaining a preset pressure for a preset time with low power input . . . quick opening of platen a short preset distance . . . quick closing of platen . . . gradual pressure increase at an adjustable rate with low power input . . . quick opening of platen to loading position.

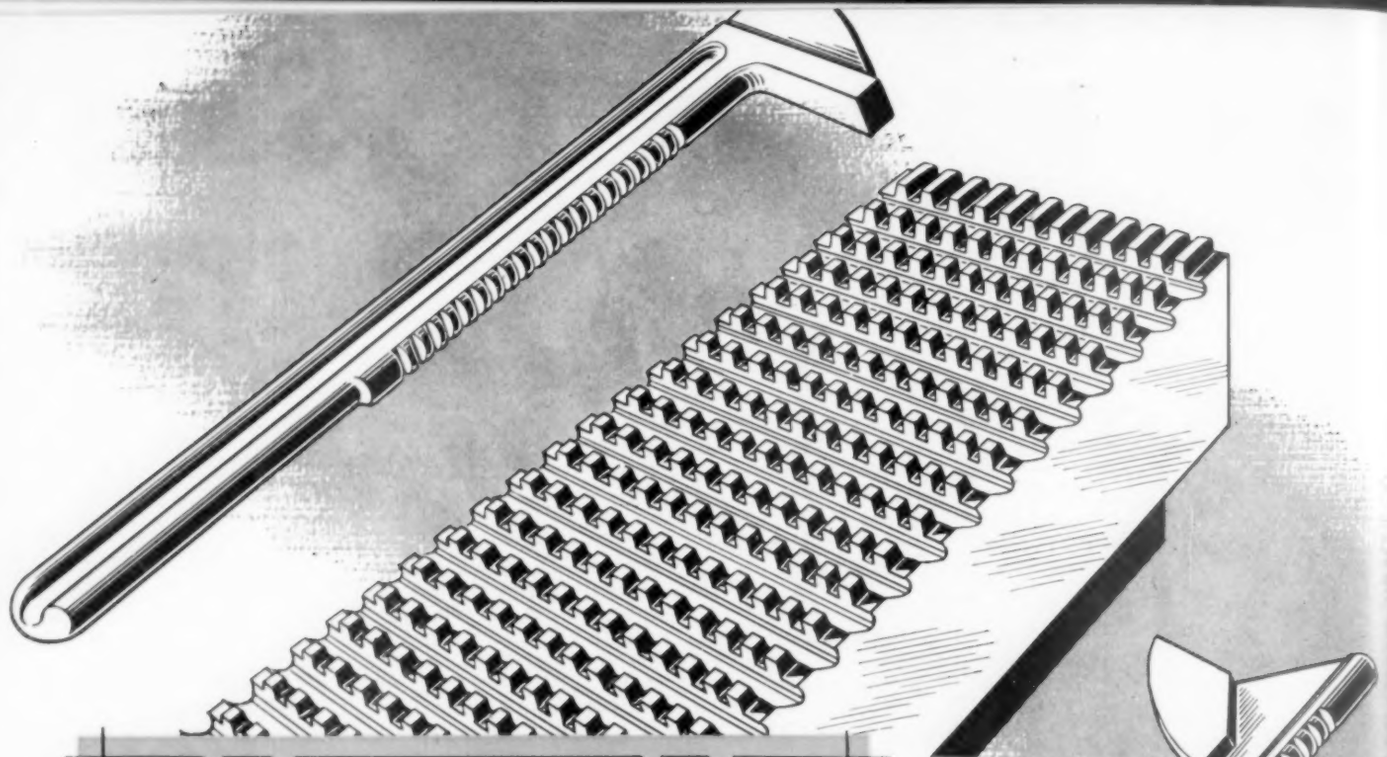
Whether you want stepless increments of power or speed, or precision control manually or automatically . . . whether you want complex combination of functions or a more conventional solution to rotary or straightline transmission problems, you *should* investigate Oilgear Fluid Power without fail and without delay. Know more about this pliant power so easily molded to your needs. Write today. THE OILGEAR COMPANY, 1308 W. Bruce St., Milwaukee 4, Wisconsin.

Oilgear Fluid Power

ARE YOU TRYING TO:

1. Apply large forces through long . . . or short . . . strokes at variable speeds? **2.** Obtain automatic work cycles, variable speeds in either direction . . . with or without preset time dwell? **3.** Apply large forces through continuous or intermittent reciprocating cycles at constant or variable velocities? **4.** Obtain extremely accurate control of either position or speed of a reciprocating member? **5.** Apply accurately variable pressure either static or in motion? **6.** Closely synchronize various motions, operations or functions? **7.** Apply light . . . or heavy . . . forces at extremely high velocities through either long or short distances of travel? **8.** Obtain continuous automatic reversing drives at constant R.P.M. or over a wide range of speed variation? **9.** Obtain accurate remote control of speed and direction of rotation, rates of acceleration and/or deceleration? **10.** Obtain constant horsepower output through all or part of a speed range? **11.** Obtain automatic torque control? **12.** Obtain accurately matched speed of various rotating elements? **13.** Obtain constant speed output from a variable speed input? **14.** Obtain full preset automatic control, elimination of problems of shock, vibration, etc.?

You Need Oilgear!



Production Efficiency

STARTS WITH BETTER TOOLS

To help you increase machine capacity and improve product quality Illinois Tool offers an experience gained in 34 years of intensive research in the development and application of metal cutting tools specifically designed to meet the requirements of each individual job.

HEADQUARTERS FOR ENGINEERED CUTTING TOOLS

Overnight to all America from the hub of air transportation.

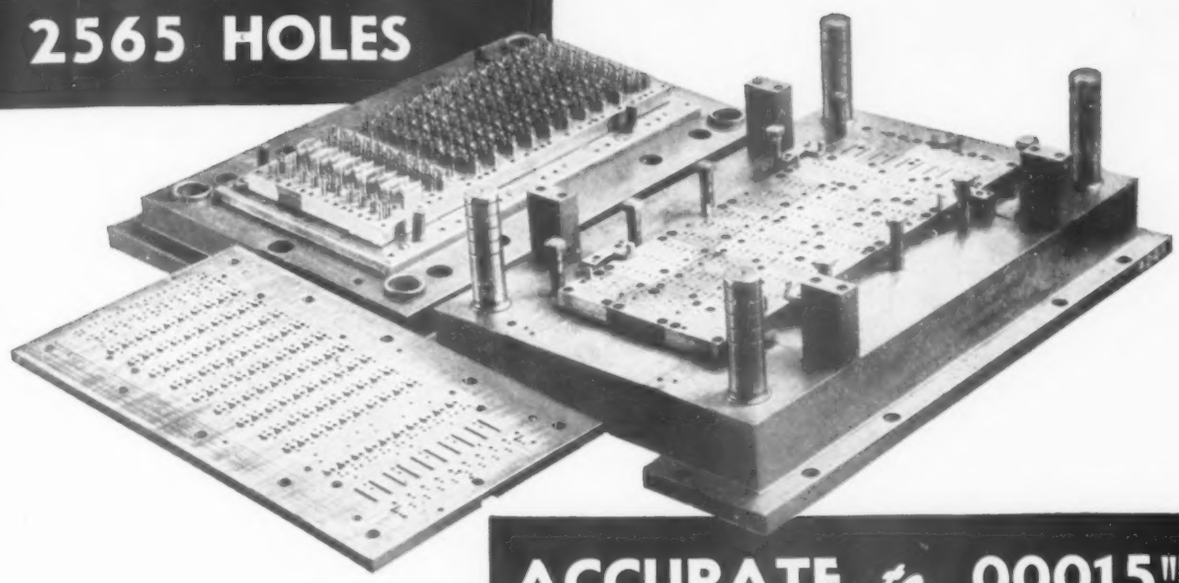
ILLINOIS TOOL WORKS

2501 N. Keeler Avenue, Chicago 39, Illinois

In Canada: Canada Illinois Tools, Ltd., Toronto, Ontario

MANUFACTURERS OF METAL CUTTING TOOLS AND SHAKEPROOF PRODUCTS

2565 HOLES



ACCURATE *to* .00015"

—try and match this SIP precision on your machine!

A SIP Jig Borer is used for this exacting job—drilling 2565 accurately spaced holes in a die, punch and stripper plate . . . And the SIP Jig Borer checks its own accuracy, for this machine is in itself a basic measuring instrument, a standard of precision to which all other shop measurements can be related. The built-in micrometer heads give direct readings to .00005 inches. By using the system of rectangular coordinates, work can be set up and holes located without any preliminary laying out. Time wasted using separate measuring instruments, or making involved calculations, or checking results is entirely eliminated. *Can you match this speed and precision with your present jig boring equipment?*

For jigs and fixtures, for development work, for precision boring, drilling and milling . . . for all those jobs which demand the ultimate in accuracy . . . SIP Jig Borers are known for their speed, their high capacity, their convenience of operation and their precision. Five sizes of SIP Jig Borers are again available, and we can quote excellent deliveries. Write for catalogs describing the many mechanical refinements which make SIP Jig Borers the world-wide choice for ultra-accurate machining.

We also represent in the United States other world-famous Swiss High Precision Equipment: Andre Bechler —Maag Gear Wheel Co.—Mikron—Safag—Studer—Sallaz —Schaublin—Lienhard—Billeter.

RANGE OF TABLE SIZES

No. 2C	18" x 10¼"
No. 3K	21½" x 15"
No. 4G	27½" x 23⅝"
No. 5G (illustrated)	43⅜" x 32"
Hydroptic-B	39½" x 32"

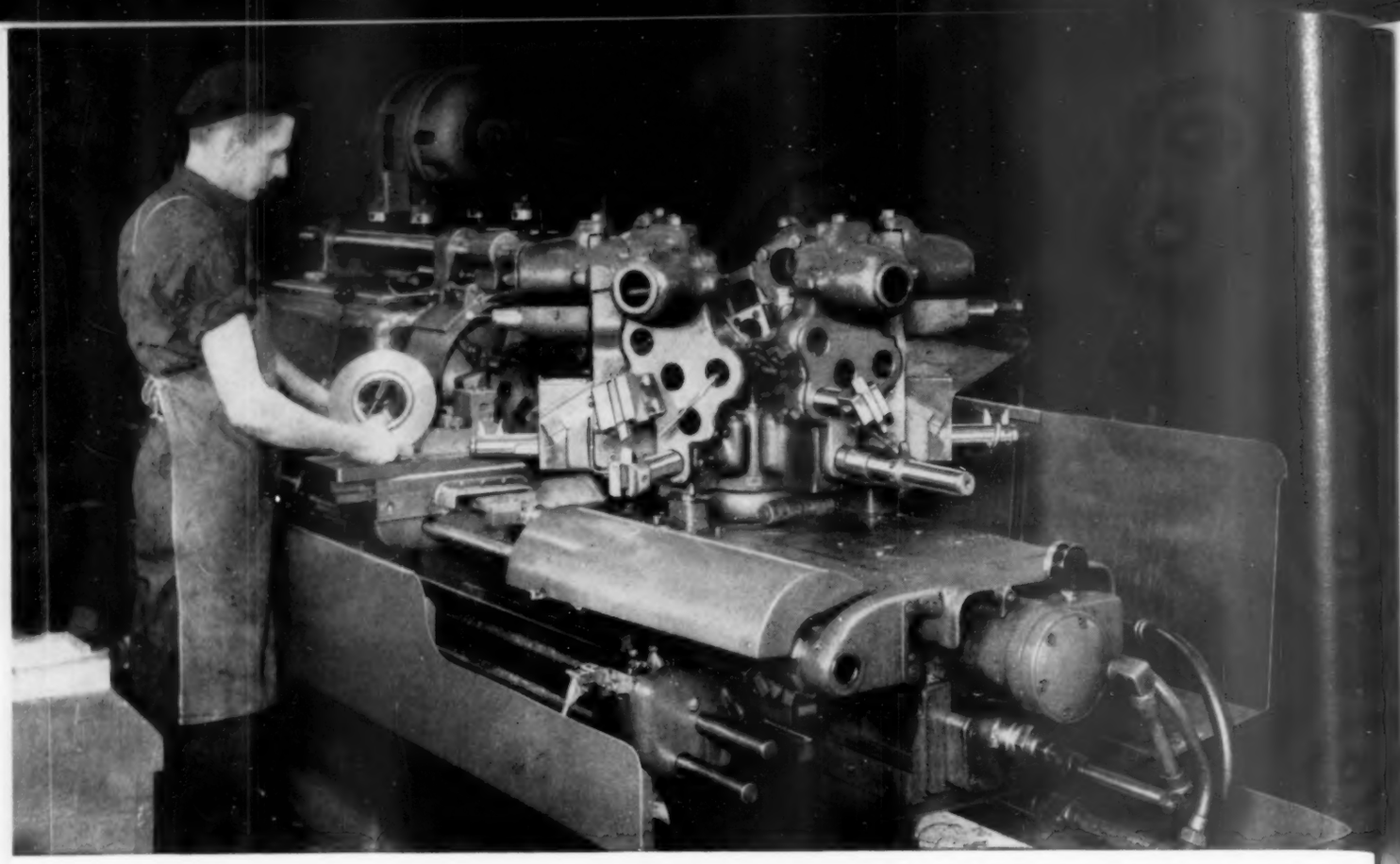
Be sure to see our exhibit at the A.S.T.E. Exposition — Cleveland, April 8-12

HIGH PRECISION MACHINE TOOLS AND MEASURING INSTRUMENTS

COSA CORPORATION

COSA

CHRYSLER BUILDING
New York 17, New York



How the *FASTERMATICS* Pay Out Faster, too!

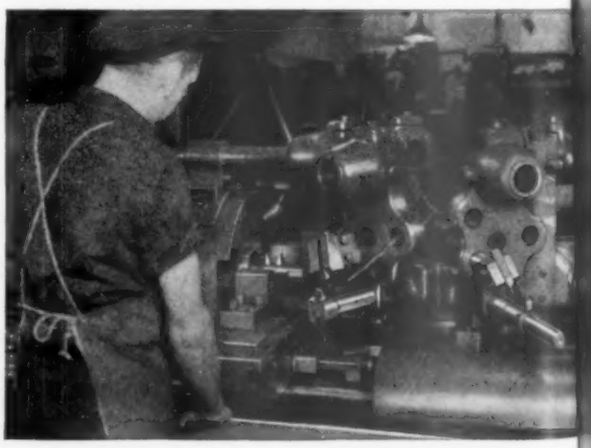
• It may seem incredible, in this day and age, for any major machine tool to "buy" itself in nine weeks' operation. Yet that's exactly what the Fastermatic did on this job of machining clutch plate hubs.

With automatic control of all machine functions, this Fastermatic reduced the former time of 15 minutes per piece, on hand-operated turret lathes, to only 3 minutes, floor to floor. Earnings piled up so fast over former production costs that the Fastermatic paid for itself in only 9 weeks, or 893 hours of operation.

If you have work that will permit a number of cuts to be done in one chucking, investigate what the Fastermatic can accomplish to bring you faster, more efficient production and lower costs. Ask for full information.

Rough Steel Forging

Machined Clutch Plate Hub



In this tooling set-up, only three turret faces are needed to turn each part. By repeating the tooling on the remaining three faces of the hexagon turret, two parts are machined with each complete turret cycle. The operator has only to load and remove the work.

GISHOLT MACHINE COMPANY

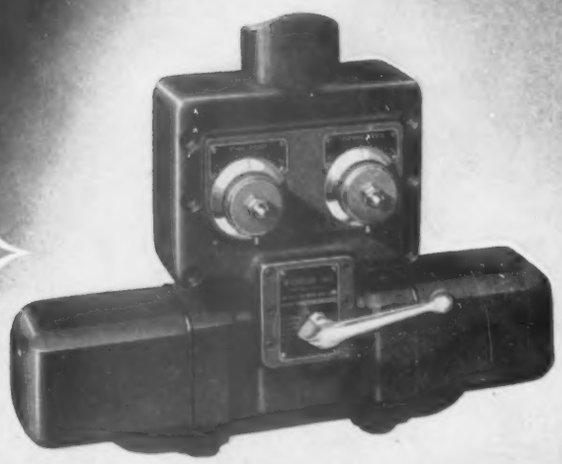
1257 E. Washington Ave. • Madison 3, Wisconsin

Look Ahead...Keep Ahead...with Gisholt

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

SMOOTH and CONSTANT FEED RATE

regardless of fluctuations in work resistance or hydraulic operating pressure



Double Solenoid Type Push-button Operation

VICKERS "Traverse and Feed Cycle" CONTROL PANELS

These panels provide self-contained, compact control units for automatic machine applications where the cycle is a combination of rapid advance, one or two feeds, and rapid return motions. The two feed rates are infinitely variable within their ranges, and adjustments can be made during feed. Applications include drilling, reaming, boring, turning, milling and swaging machinery.

The hydraulic circuit in the panel employs the well-known Vickers Flow Control Valve in a "metering-out" circuit which means a smooth and constantly maintained feed rate for any given adjustment regardless of fluctuations in cutting tool resistance or changes in hydraulic operating pressure.

Simplicity is evident from the fact that there are only two working parts that move. Many standard modifications are available; feeds can be in either direction or both directions; operation is by single or double solenoids integral with panel, separate solenoids or pilot pressure. Practically any cycle sequence can be obtained. See Bulletin 41-10 for complete information.

Vickers Application Engineers will gladly discuss with you how "hydraulics" can be used to your advantage.

VICKERS *Incorporated*

Application Engineering Offices:

1416 OAKMAN BLVD. ● DETROIT 32, MICHIGAN

CHICAGO • CINCINNATI • CLEVELAND • DETROIT • LOS ANGELES

NEWARK • PHILADELPHIA • ROCHESTER • ROCKFORD • TULSA • WORCESTER

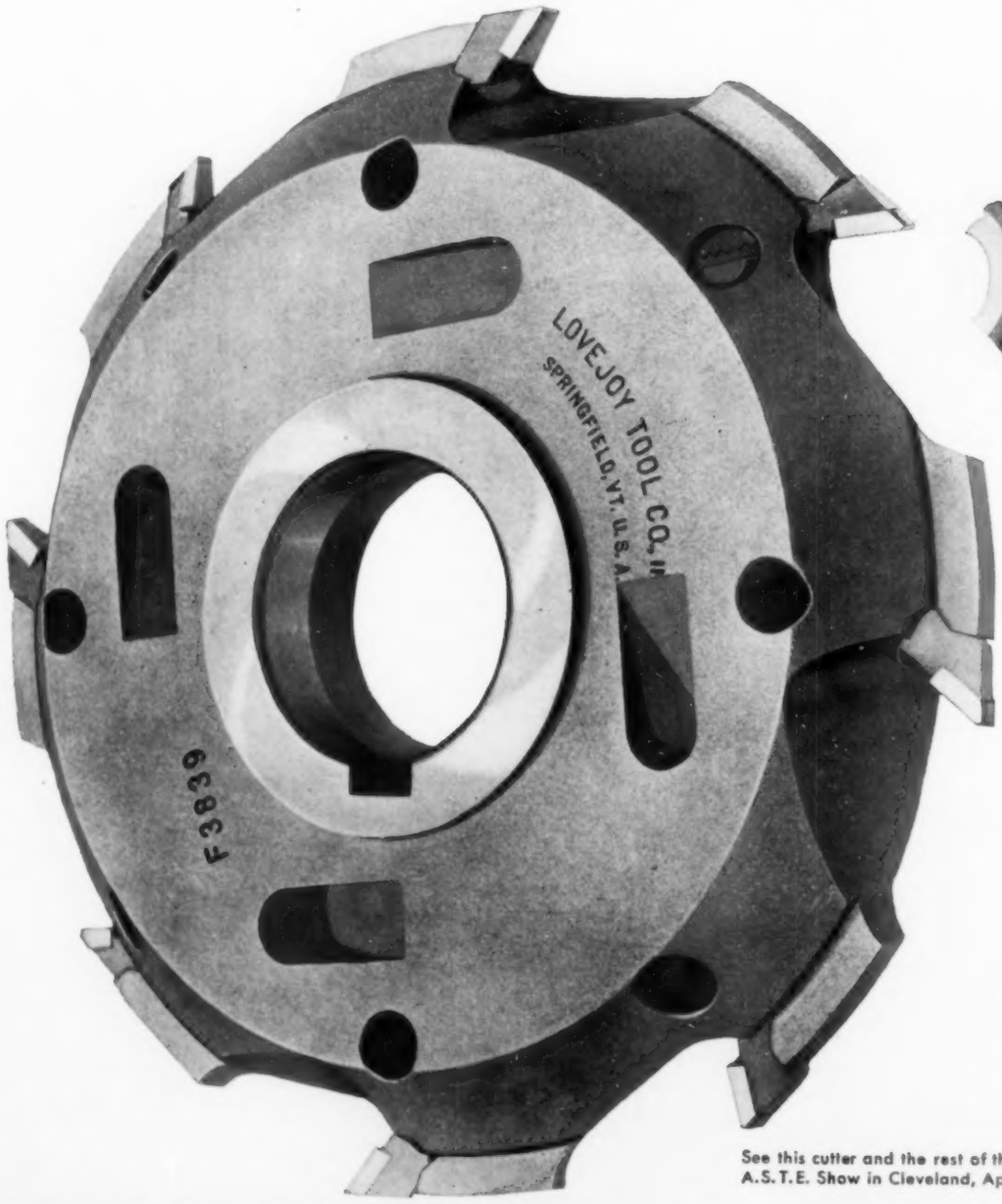
Representative of More than 5,000 Standardized Vickers Units for Every Hydraulic Power and Control Function

Another LOVEJOY TYPE "F" SLOTTING CUTTER

Here is another in the new line of Type "F" Lovejoy Slotting Cutters. It's really a demon for punishment—note the husky forged steel body—the backing behind every blade—the extra large carbide tips. For all its massiveness, it has the new Lovejoy feature of extra fine blade adjustment. The phantom view, at right, shows this new time and money saving feature—it's the tested and proven Lovejoy positive-locking device, *plus a screw adjustment.* This allows fine blade settings so that slots can be milled to exact width tolerances —it means savings on carbide, because each tip need only be cleaned up when resharpening.

Write for interesting performance data, and let us analyze your job requirements—be sure to ask for Catalog No. 27.

with NEW FINE BLADE ADJUSTMENT



Phantom view showing details of fine blade adjustment.

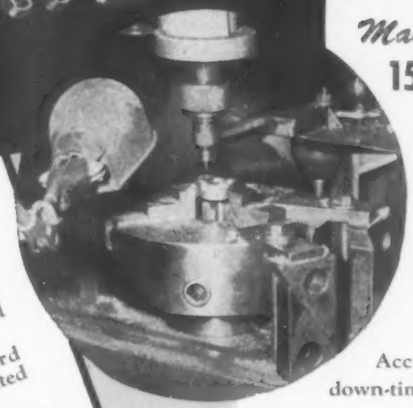
See this cutter and the rest of the modern Lovejoy line at the A.S.T.E. Show in Cleveland, April 8-12.

LOVEJOY TOOL COMPANY, Inc. **Springfield, Vermont**

Injection Molds Completed

5 TIMES FASTER ON A GORTON

3-DIMENSIONAL PANTOGRAPH



JOB FACTS

NAME OF PART—Injection Mold.
MATERIAL—Tool Steel (oil hardening).
MACHINE—Gorton 3-Dimensional Engraver Model 3-L.
ATTACHMENTS—Standard three jaw chuck mounted on table.
TOOLS USED—Special Cutters ranging from .035" dia. to .340" dia.
TEMPLATE USED—2 to 1 frill shape master.
FORMER TIME—15 hours per mold.
PRESENT TIME—3 hours per mold.
ACCURACIES—All dimensions held to .0005".

Machining Time Reduced from 15 Hours to 3 Hours per Mold

ACCURACIES HELD TO .0005"

Here's an example of the type of performance you'll get on a Gorton 3-Dimensional Pantograph Engraving Machine. This large manufacturer experienced difficulty in the production of these injection molds. Time required was 15 hours per mold. Accuracies were hard to maintain. Machine down-time was excessive. Man hours were wasted.

In an effort to remedy these, the job was tooled-up on a Gorton 3-Dimensional Engraving Machine. First an enlarged master template was cut. Then, using this as a pattern, the desired molds were turned out at the correct size at the rate of one every 3 hours. The other disturbing factors were also remedied. Dimensions were held to .0005" due to Gorton pantographic reduction method. Down-time was drastically reduced. Man hours were conserved.

QUALITY WORK ON A PRODUCTION BASIS

Gorton Pantograph Machines are noted for the consistency with which they turn out quality work on a production basis. They are available in both 2 and 3-dimensional models to handle many types of reproduction assignments. They can be used with high efficiency on any machinable material and their operation is extremely simple.

HOW TO PREDETERMINE THE RESULTS OF TOOLING YOUR JOB ON A GORTON PANTOGRAPH

Send detail prints or a work sample to Gorton Engineering Service at the address below. Tooling information and production estimates will be furnished promptly—no charge or obligation. You can then predetermine the possible improvement over your present methods.

FREE ADDITIONAL INFORMATION

Get the details on Gorton Pantographs and other Gorton machines by sending today for your copy of Bulletin No. 2604

GEORGE GORTON MACHINE CO.

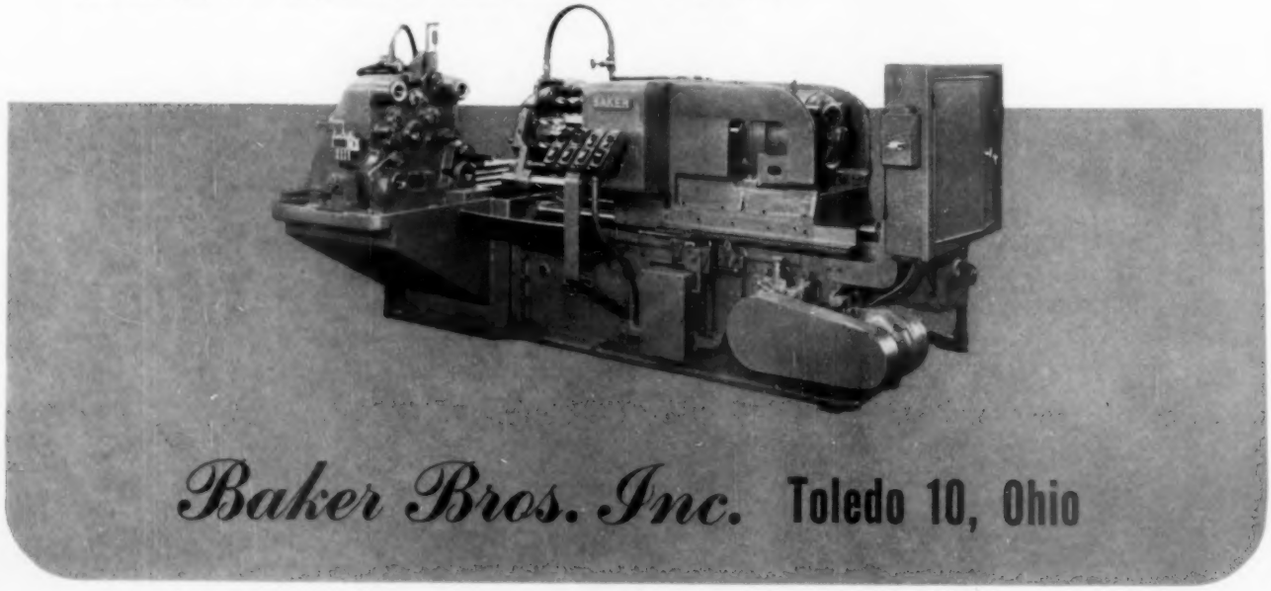
2604 RACINE STREET, RACINE, WISCONSIN, U.S.A.

FOR AGGRESSIVE, MARKET-WISE PRODUCTION GO TO TOWN WITH AUTOMATIC *BAKER* MACHINES

The need for low-cost, large-scale production at this critical moment in the American economy emphasizes once again the remarkable capacity of Baker Brothers' fully automatic, multiple spindle machines. If you want great accuracy, production speed, minimum operator fatigue, call in a Baker engineer for free consultation without any obligation. By studying the problems of countless now-famous manufacturers, we have been able to design the finest and most workable machines for shops of every size. Baker leads because its consultants never stop analyzing the requirements of American industry.

Illustrated below is Baker Model 3½x24 multiple spindle machine with fully automatic cycling. The multiple head carries 15 spindles—eight at front station for drilling several holes from solid and rough-boring center large bore; and seven at rear for finish boring and counterboring. Special work holding fixture on slide permits easy chucking.

After a push of the handy starting button, Baker takes over. Work-holding fixture moves accurately to front station and multiple head on hydraulic unit goes through cycle. Then fixture carries work to rear station for final boring and counterboring. Then as rear spindles return to rest position, fixture carries work back to original chucking position. *All these precise operations are cycled in an unbroken series.* This is a typical example of how Baker machines raise production, insure accuracy, and lower cost.

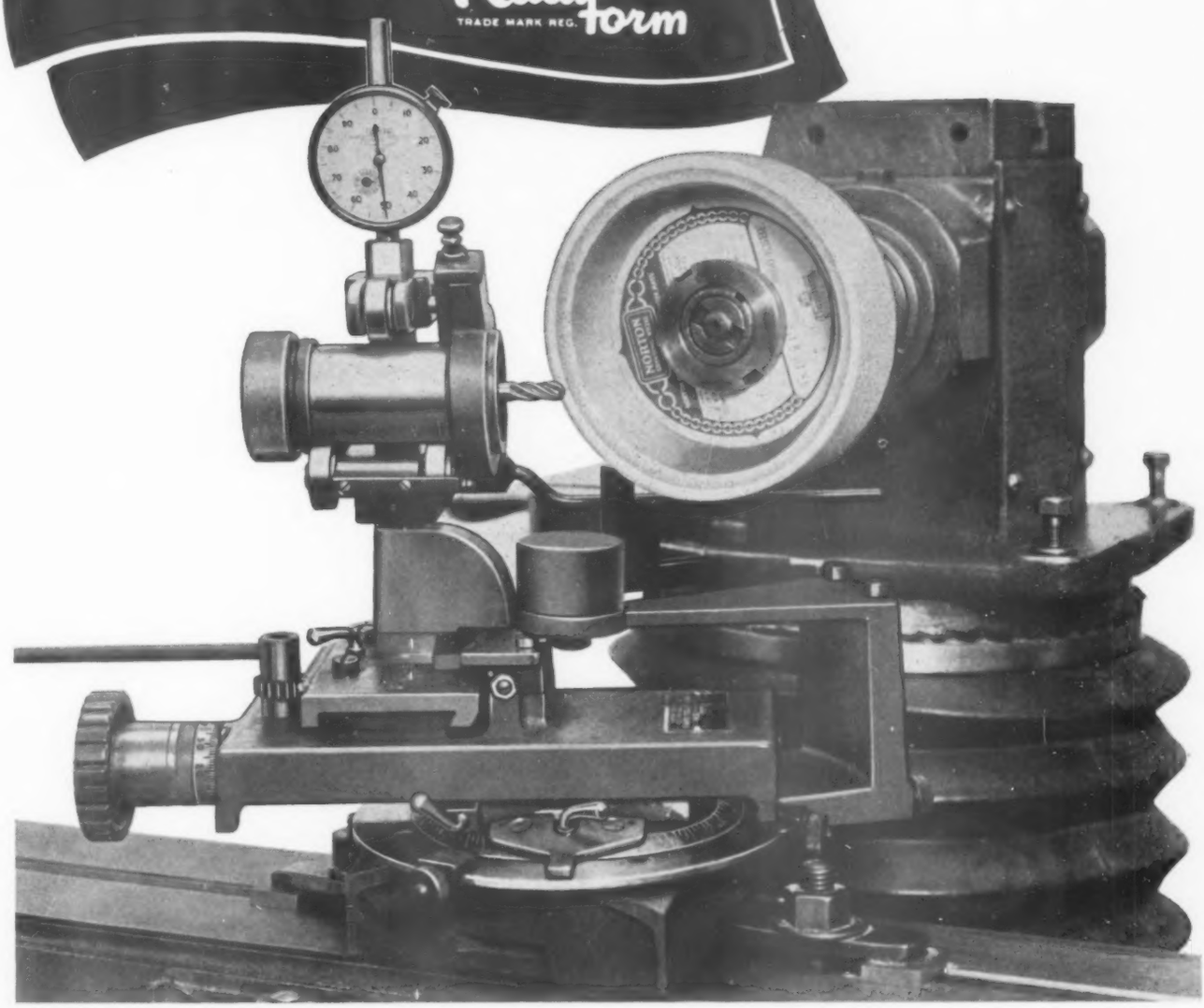


Baker Bros. Inc. Toledo 10, Ohio

HERE IT IS!

THE IMPROVED MEYERS Radiform

TRADE MARK REG.



PATENTS PENDING

● THE ONE MACHINE that generates the form direct on, End Mills, Tool Bits, Milling Cutters and similar tools in high speed and tungsten carbide without first forming the grinding wheel; also forms grinding wheels.

THE IMPROVED MEYERS RADIFORM NOW AVAILABLE

For further information and details wire or write

W. F. MEYERS COMPANY • *Established 1888*

1024 FOURTEENTH STREET • • • BEDFORD, INDIANA

Engineered Hole Location Service Brings Interchangeability to Toolmaking

Complex tools and dies can now be produced like automobile parts—on an interchangeable parts and assembly basis—with the Moore Jig Borer and Moore Jig Grinder working together as toolroom partners.

Moore Jig Borer Spots · Drills · Bores or Reams all Holes with Minimum Tool Changes

Moore Jig Grinder Relocates Holes in Hardened Parts by Finish-Grinding

With both machines working to pre-engineered dimensions, die, stripper and punch plates can be made *concurrently* by several toolmakers instead of progressively as a one-man job. And greater accuracy and economy are achieved. Here's how:

Both the Moore Jig Borer and Jig Grinder employ lead screw measuring principle and convenient system of coordinate hole location. Lead screws hardened and ground to .0002″ over 14″ of travel and within .00005″ in any given inch are built into the machines... assure precise, rapid table settings within .0001″.

Coordinate calculations, made by engineering department, are used throughout—in boring the soft pieces and finish-grinding the hardened parts. All work is done to figures instead of to "fit"—promotes greater accuracy and saves operator's time.

Parts are made concurrently. Errors in hardened pieces are corrected, *not transferred* to other parts. This permits several toolmakers to work on the job at once, speeding die delivery to your press room.

Both machines inspect own work before removal from the machine. By simply inserting a dial indicator in place of the boring or grinding tool and resetting the micrometer lead screws to the original specification, errors in earlier settings are immediately apparent and readily corrected without disturbing the set-up.

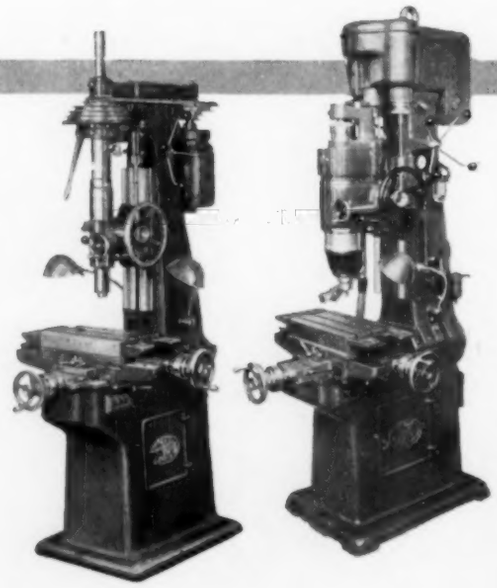
Mass-die-production has many other advantages... saves over-all toolmaking hours... lowers tool costs... increases toolroom capacity... prolongs tool life.

Why not investigate how this Engineered Hole Location Service can increase the productivity of your toolroom and production methods. Write today—

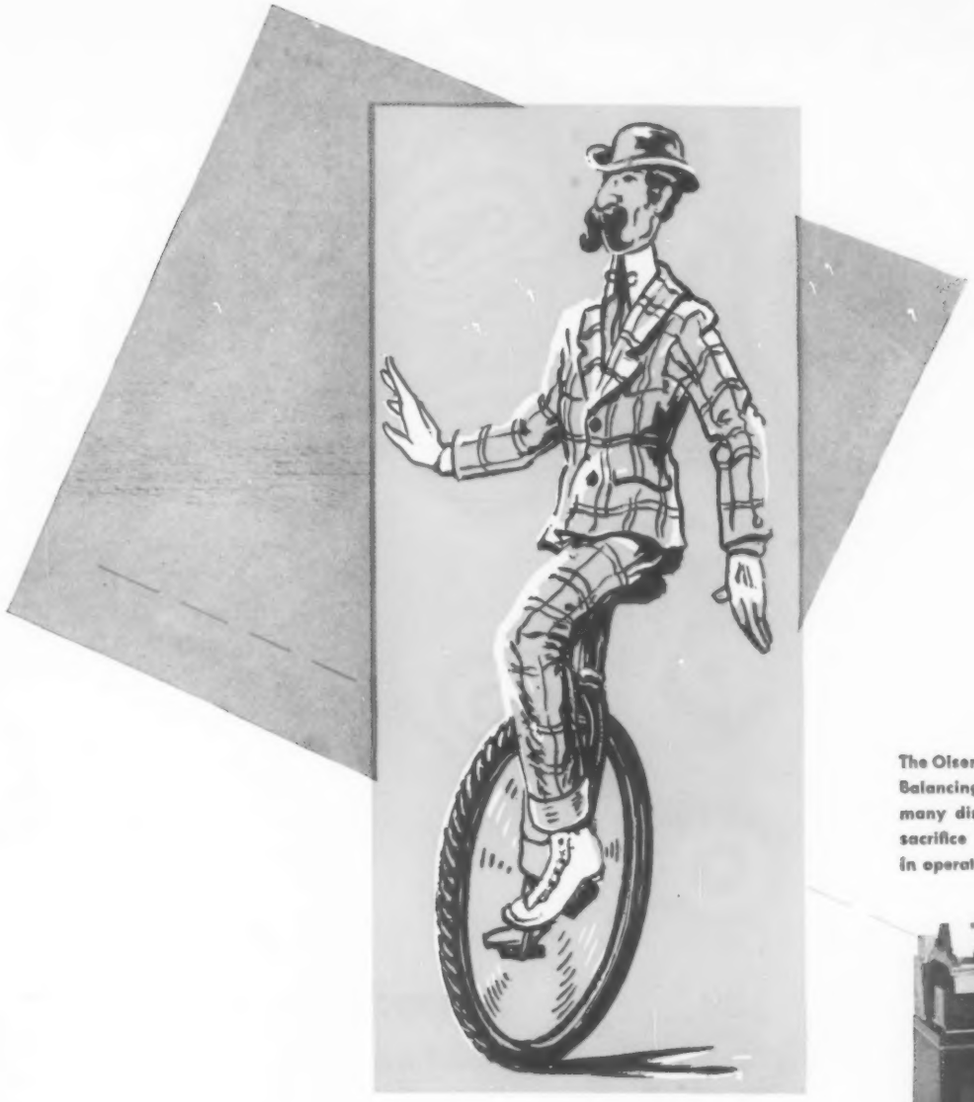
MOORE SPECIAL TOOL COMPANY, INC.
732 UNION AVENUE, BRIDGEPORT 7, CONNECTICUT

MOORE TOOLS

MOORE JIG BORER



MOORE JIG GRINDER



The Olsen Type E-O Static-Dynamic Balancing Machine incorporates many distinctive features without sacrifice of simplicity and speed in operation.

THIS KIND OF BALANCE WILL NEVER DO . . .

When you know the exact angle and amount of unbalance in a rotating part, it is an easy matter to make accurate corrections to eliminate vibration, noise and wear. * * * Significant production advantages result from the use of Olsen Static-Dynamic Balancing Equipment. Write today for Bulletin No. 26 which details the simplicity of construction and operation of Olsen Balancing Machines.

OLSEN

BALANCING MACHINES
and PHYSICAL TESTING EQUIPMENT

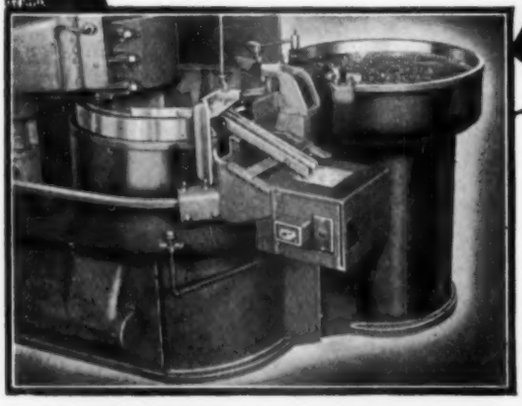
THERE IS AN OLSEN BALANCING MACHINE TO BALANCE ANY ROTATING PART . . , FROM MINIATURE MOTOR ROTORS TO PARTS WEIGHING UP TO 25,000 POUNDS

TINIUS OLSEN TESTING MACHINE COMPANY
518 NORTH TWELFTH STREET • PHILADELPHIA 23, PA.

Representatives: **PACIFIC SCIENTIFIC CO., Los Angeles, San Francisco, Seattle • MINE and SMELTER SUPPLY CO., Denver, Colo.**

For High Production Only!

LET HANCHETT ENGINEERS HELP YOU DESIGN SPECIAL FIXTURES FOR THE JOB.



The HANCHETT 36-A

Automatic SURFACE GRINDER *For Fast, One-Pass Finishing of Smaller Parts . . .*

Here's the machine for you, if you're troubled with production grinding problems on small parts. For example, (left) a Hanchett 36-A grinds steel castellated nuts, 7/16" across flats. Power-driven rotary loading table feeds parts. Production — 75 pieces per minute, with .015" stock removal, both top and bottom. Parts automatically discharged from work table into chute through demagnetizer. Accuracy is assured because of the work sizer which checks each piece and automatically compensates for wheel wear. The 36-A is only one of the complete line of Hanchett Grinders. Consult Hanchett on any grinding problems. Since they make *all* types of surface, face and disc grinders, you can be sure of unbiased information.

Write for Bulletin No. 145-1TD

HANCHETT GRINDERS — BIG RAPIDS MICHIGAN

IF IT'S A FLAT SURFACE—THERE'S A HANCHETT TO GRIND IT

HANCHETT MANUFACTURING CO.
BIG RAPIDS, MICHIGAN U.S.A.

HANCHETT HERMETI-COIL MAGNETIC CHUCKS

THE OFFICE OF TOMORROW

is on the Press Today

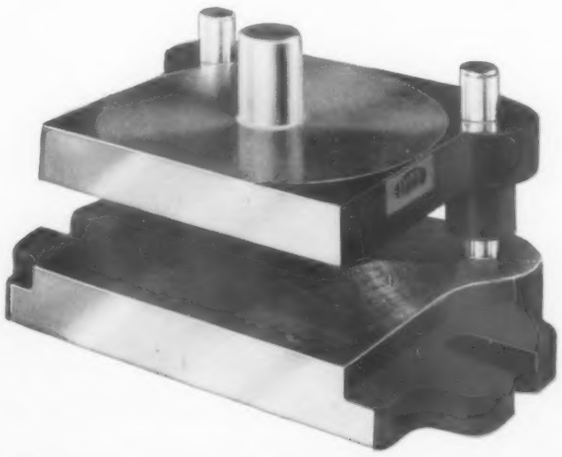
The clean lines and rounded contours of modern office furniture and equipment—the innumerable duplicated parts in typewriters, calculators and other office machines are ideally suited to Press Production. The Punch Press is the best and fastest method of duplicating parts for the vast field of industrial and business machines; and the entire Stamping Industry recognizes Danly Die Sets as vital in speeding die making programs, press production, and eliminating "downtime" because Danly means *known dependable accuracy.*

DANLY MACHINE SPECIALTIES, INC.
2100 South 52nd Avenue • Chicago 50, Illinois

DANLY
National Assembly

Call Danly

- **MILWAUKEE 2** — *111 East Wisconsin*
- **DETROIT 16** — *1549 Temple Avenue*
- **CLEVELAND 14** — *1550 East 33rd Street*
- **DAYTON 2** — *990 East Monument*
- **ROCHESTER 4** — *16 Commercial Street*
- **PHILADELPHIA 40** — *3858 Pulaski Avenue*
- **LONG ISLAND CITY 1** — *47-28 37th Street*
- **DUCOMMUN METALS & SUPPLY CO.** — *4890 South Alameda, Los Angeles*

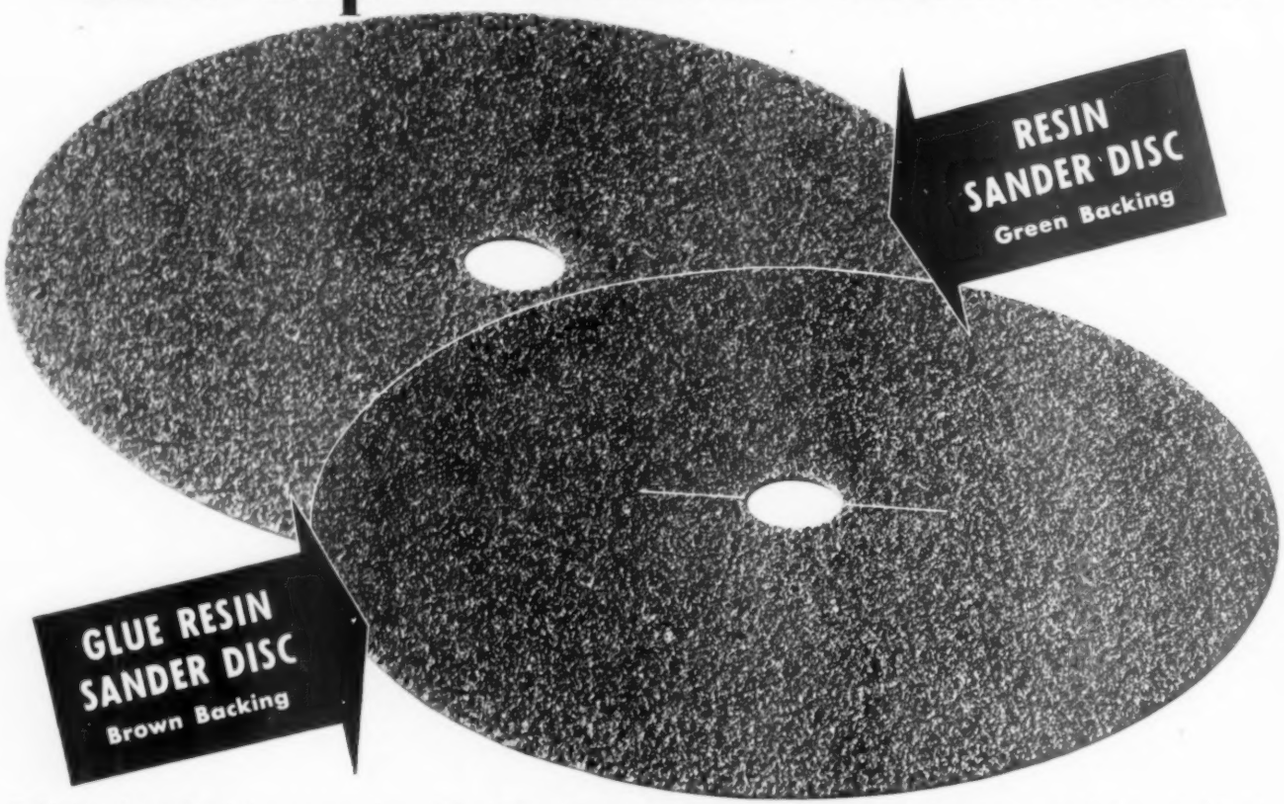


DIE MAKERS SUPPLIES

DANLY DIE SETS

Welded Steel Fabrication

FIRST NEWS about a BIG improvement in Sander Discs



This is the first information on two new sander discs by CARBORUNDUM. They have such improved performance that we want to get the news to you as soon as possible. A quick listing of advantages would include:

1. **Substantially longer life.**
2. **Faster cutting.**
3. **Heat resistant.**
4. **Broad application in metal surfacing.**

The obvious benefit, of course, will prove to be more production at lower abrasive cost.

The Glue-Resin Sander Disc by CARBORUNDUM, with brown backing, will be found to give broad usage and unusual service in all metal surfacing operations. It is available in the following six grit sizes: 16, 24, 36, 50, 60, 80.

The Resin-Sander Disc, with green backing, and same grit selection as the Glue-Resin Disc by CARBORUNDUM is specially recommended for severe sanding operations and the edge-wear grinding jobs which take such a heavy toll of ordinary discs. The backing of both discs are marked for ready identification, usage and reordering.

These discs by CARBORUNDUM are standard in 7″ and 9⅛″ dia. The Glue-Resin Sander Discs are available in Type D-1 (center hole with slits) while the Resin Sander Discs are available in Type D-2 (center hole only). Prompt deliveries will be made from standard stocks in plant and branch warehouses.

Call your CARBORUNDUM salesman or distributor's representative for complete information. The Carborundum Company, Niagara Falls, N. Y.

For sanding and finishing satisfaction... **CALL IN**

CARBORUNDUM

TRADE | MARK

BONDED ABRASIVES

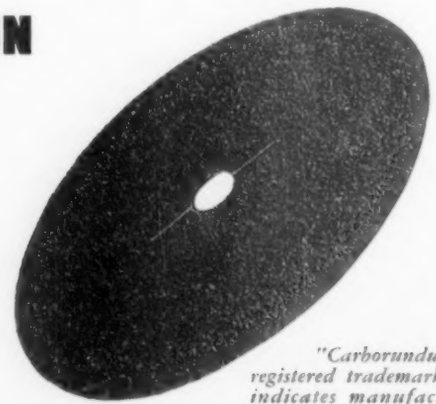
WHEELS
Silicon Carbide
Aluminum Oxide
Diamond
Cylinder Hones
Sticks, Stones & Rubs
Specialties

COATED ABRASIVES

Paper, Cloth and Combination
Sheets, Rolls, Discs

ABRASIVE GRAINS AND COMPOUNDS

for:
Polishing
Lapping
Pressure Blasting
Finishing



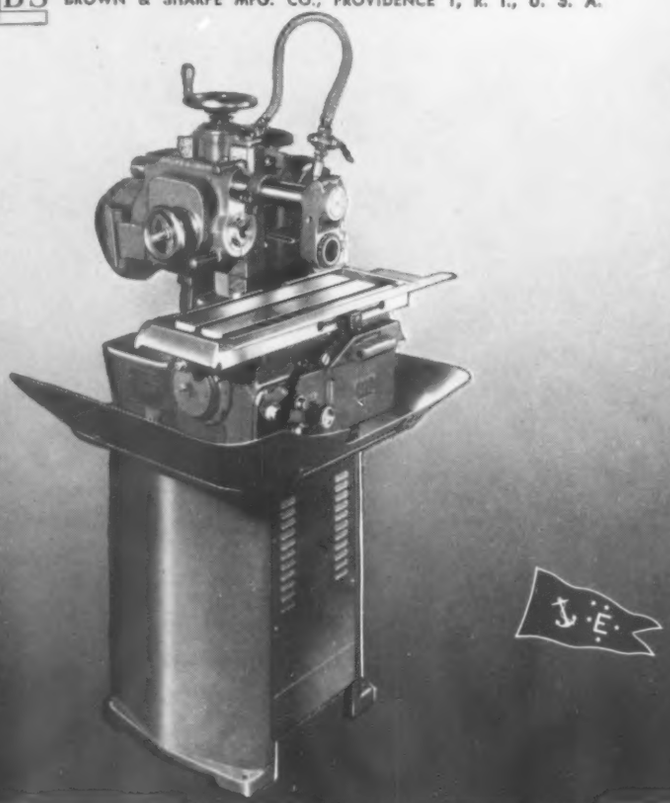
"Carborundum" is a registered trademark which indicates manufacture by The Carborundum Company

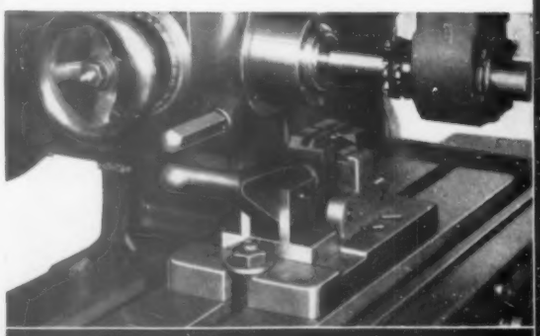
ADAPTABILITY OF Nº 000

• • • TO A WIDE VARIETY OF WORK-HOLDING FIXTURES IMPROVES PRODUCTION OPPORTUNITIES ON SMALL PARTS MILLING

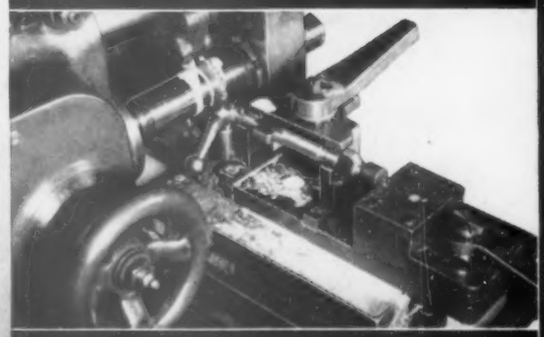
Check the savings possible on the No. 000 Plain Milling Machine — either with standard equipment — or with equipment especially designed for a specific purpose.

B·S BROWN & SHARPE MFG. CO., PROVIDENCE 1, R. I., U. S. A.

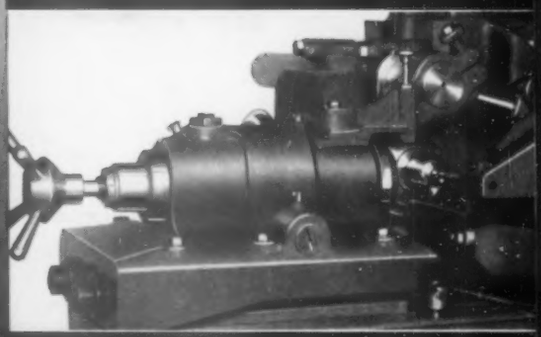




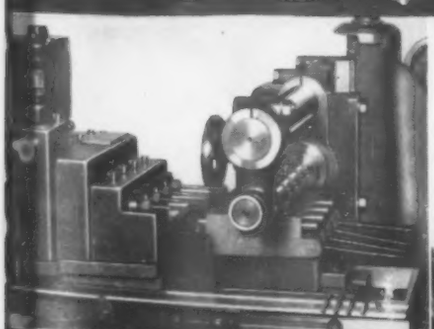
Simple clamping fixture for milling a flat on a small camshaft — two at a time.



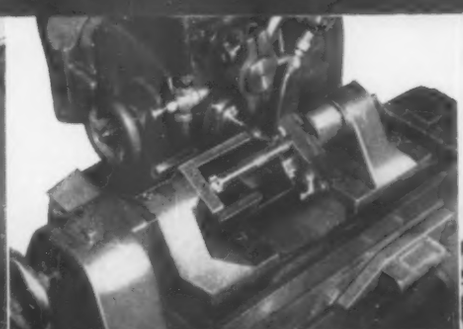
Cam-operated fixture for milling the sleeve lock in a rifle bolt—a fast, short cut.



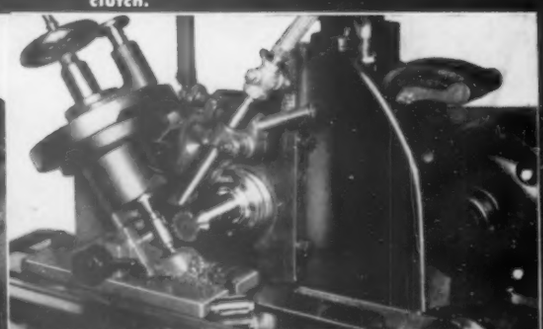
Automatically rotated fixture makes two quarter-turn helical cuts in a spiral-jawed clutch.



Automatic indexing and clamping fixture for milling flutes in four taps simultaneously.



Profiling fixture for automatically milling extractor cam on rifle bolt.



Hand-indexed fixture for cutting longitudinal slots in hydraulic pump rotor.

Why *slow down* a good operator — doing work that can be done *better* by . . .

THE CUSHMAN *power wrench*

fast . . . safe . . .

accurately controlled jaw pressure

DESIGNED AND BUILT BY CHUCK SPECIALISTS TO DO THE JOB *RIGHT*

- Mounting permits fingertip swiveling on bracket. Stop provided on spline shaft to control end movement of shaft as chuck indexes away from workloading station.
- Control box with thumb screw adjusted bar to make possible easy changeover to new torque load and chuck gripping pressure.
- Heavy duty drum switch or push button and reverse line starter control standard equipment as specified.
- Torque motor designed to provide patented brake means thus controlling speed of motor and inertia of rotating parts.

Thoroughly tested and proved on famous production lines, the Cushman Power Wrench furnishes the perfect solution to the problems of opening and closing heavy chucks on repetitive operations. Both the Power Wrench and its electrical control accessories are so simple to operate that the machinist will require but little instruction to become quick and efficient in their use. Yet the equipment has been so carefully engineered that previous difficulties in accurately controlling the torque (and hence jaw pressure) have been completely overcome. With the Cushman Power Wrench torque may be predetermined and set at any desired value from 150 to 600 lbs. ft. at the Wrench end. Action of the Power Wrench is positive and fast with automatic safeguards to prevent starting the head until the Wrench shaft has been withdrawn from the chuck.

For key features see column at left. For Engineering Bulletin giving detailed information, specificaitons and prices, write direct to

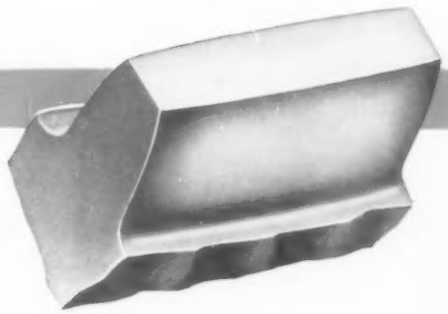
THE CUSHMAN CHUCK COMPANY • Hartford 2, Connecticut

A WORLD STANDARD FOR PRECISION

CUSHMAN CHUCKS

You can depend upon your Cushman Distributor for expert, experienced assistance in the solution of your work holding problems. Call on him.

ELLIPTOID TEETH for the Modern HEAVY DUTY GEAR



The Elliptoid tooth form has a very important function. It confines operating load concentrations to the strong central region of the tooth and prevents such concentrations at the ends of the tooth where it is weakest and therefore most vulnerable to failure.

The actual difference in tooth thickness between the ends and center of an Elliptoid tooth need be very little (.0003" to .0005" per inch of face) but when that difference is consistently maintained the tooth always develops its maximum operating strength.

The Elliptoid tooth form is developed on Red Ring Rotary Shaving Machines which, in addition, correct errors in tooth spacing, helical angle, profile, eccentricity and surface finish.

NATIONAL BROACH AND MACHINE CO.

5600 ST. JEAN — RED RING ◯ PRODUCTS — DETROIT 13, MICH.

SPECIALISTS ON SPUR AND HELICAL INVOLUTE GEAR PRACTICE

ORIGINATORS OF ROTARY SHAVING AND ELLIPTOID TOOTH FORMS

SPECIAL TAPS *can cost less than* STANDARDS

It is frequently more economical to use a special Detroit tap than a lower cost "standard". Reason for this is that DETROIT really designs specials "to the job". At Detroit that means taking into account not only general thread specifications, but characteristics of the materials to be tapped, tolerances required, whether another operation—such as drilling or reaming, or a second tapping operation—can be performed by the same "special".

It would be difficult to determine whether the machines which Detroit Tap and Tool has developed for producing all kinds of specials or the knowledge of tap design problems presented by different materials are more responsible for the outstanding success of DETROIT specials.

Our extensive field engineering force, as well as our Detroit design engineering staff are at your disposal. They will be glad to help you cut machine hours, reduce rejections, eliminate operations and improve the quality of your tapped holes.

Send us a part print of that "tough" job today.

DETROIT

TAP & TOOL CO.

8432 BUTLER AVE. • DETROIT 11, MICHIGAN

NOW . . .

A BULLARD CUT MASTER V.T.L. PUTS SPEED CHANGES AT YOUR FINGERTIPS

New Pendant Control with Speed Dial and Clutch-Brake Lever Located Where You Want Them

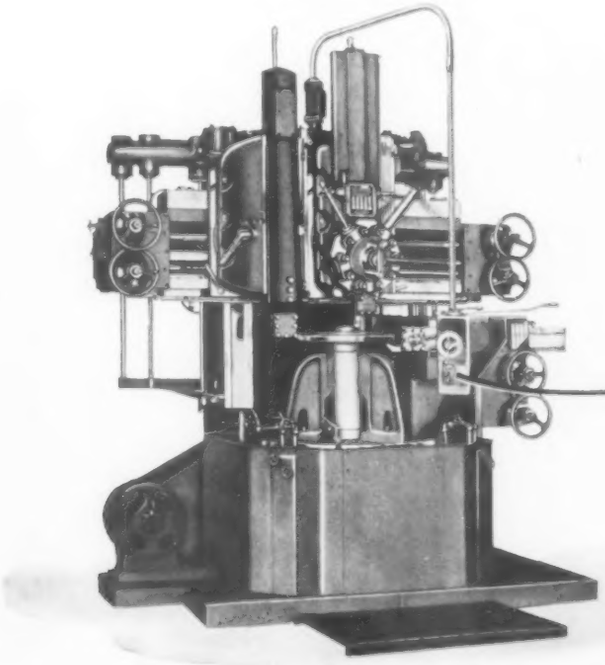
The addition of this entirely new and different Pendant Control to all Bullard Cut Master Vertical Turret Lathes provides a high degree of control and operating efficiency not found in other machine tools.

This is how the Bullard Pendant Control works. With the machine operating and a speed change needed, you throw the switch lever to "BRAKE ON" . . . rapidly dial the new speed (an exclusive Bullard Pendant Control feature) . . . throw the lever to "CLUTCH IN". That's all! . . . gears are quietly and almost instantaneously shifted through electrically-controlled, hydraulically-operated mechanisms. When you want to jog the table any fraction of a revolution for positioning or indicating, you merely manipulate the single switch lever.

This new Pendant Control is suspended at the most convenient operating height. It swings in an arc to whatever position is required for ease of operation.

For facts about other features that make Bullard Cut Masters your best investment *for cutting time on and between cuts*, write for Bulletin CVTL-4-1, today. The Bullard Company, Bridgeport 2, Connecticut.

This unique Pendant Control is now a standard specification on all Bullard Cut Master Vertical Turret Lathes which are available in 30" and 36" sizes with two heads . . . in 42", 54", 64" and 74" sizes with two or three heads.



BULLARD

CREATES *NEW METHODS*

TO MAKE MACHINES DO MORE

Now...Elgin *Sapphire* Tipt MICROMETERS

2,000,000
PRODUCTION GAGINGS

The original Elgin Sapphire Tipt Micrometer is in use without wear after more than 2,000,000 gagings in a drill plant.

READY FOR SHIPMENT NOW. 1"—$25, 2"—$26.50, 3"—$28. Discount on quantities. Elgin Sapphire Gages have been outwearing steel as much as 7,000 to 1. Now Elgin Sapphire has been mounted on the anvil and spindle of a superbly engineered lightweight micrometer. Here is a micrometer to give accuracy you can always be sure of . . . and to save you man-hours, money, materials.

FEATURES OF THE ELGIN MICROMETER
- Sapphire Tipt Anvil and Spindle
- Adjustable Spindle Bushing
- Hollow, Lightweight Frame of Stabilized Steel
- Tool Steel Hardened-Ground Spindle Thread
- Positive Lock Nut
- 1/10 Thousandths Graduations (by precision graduating machine)

SAPPHIRE PRODUCTS DIVISION
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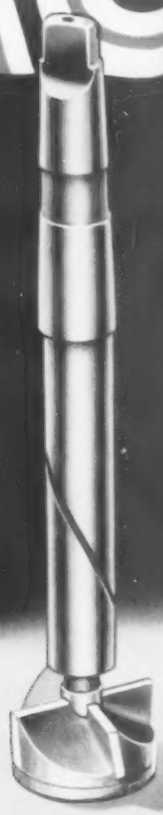
REPRESENTATIVES IN CITIES FROM COAST TO COAST

·ELGIN·
Sapphire Gages
DIMENSIONAL FIDELITY IN GAGING OPERATIONS

FACTS about



Inverted SPOTFACERS

The inverted spotfacer is usually constructed with detachable cutter and holder, so that the tool may be used in machining inaccessible surfaces. They can be made special with flutes along the side for deep counterboring purposes. The end teeth are cut ahead of center to produce a shearing action which eliminates chatter and "hogging".

NATIONAL manufactures a wide variety of spotfacing tools and counterbores, of special and standard design. For best tool performance at minimum cost, specify NATIONAL tools—the National choice.

Call Your DISTRIBUTOR!

Leading distributors in every section of the country have stocks of NATIONAL Cutting Tools. Every NATIONAL distributor offers factory-trained engineers to serve you. Call your NATIONAL distributor for cutting tools or any staple industrial product.

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TWIST DRILLS
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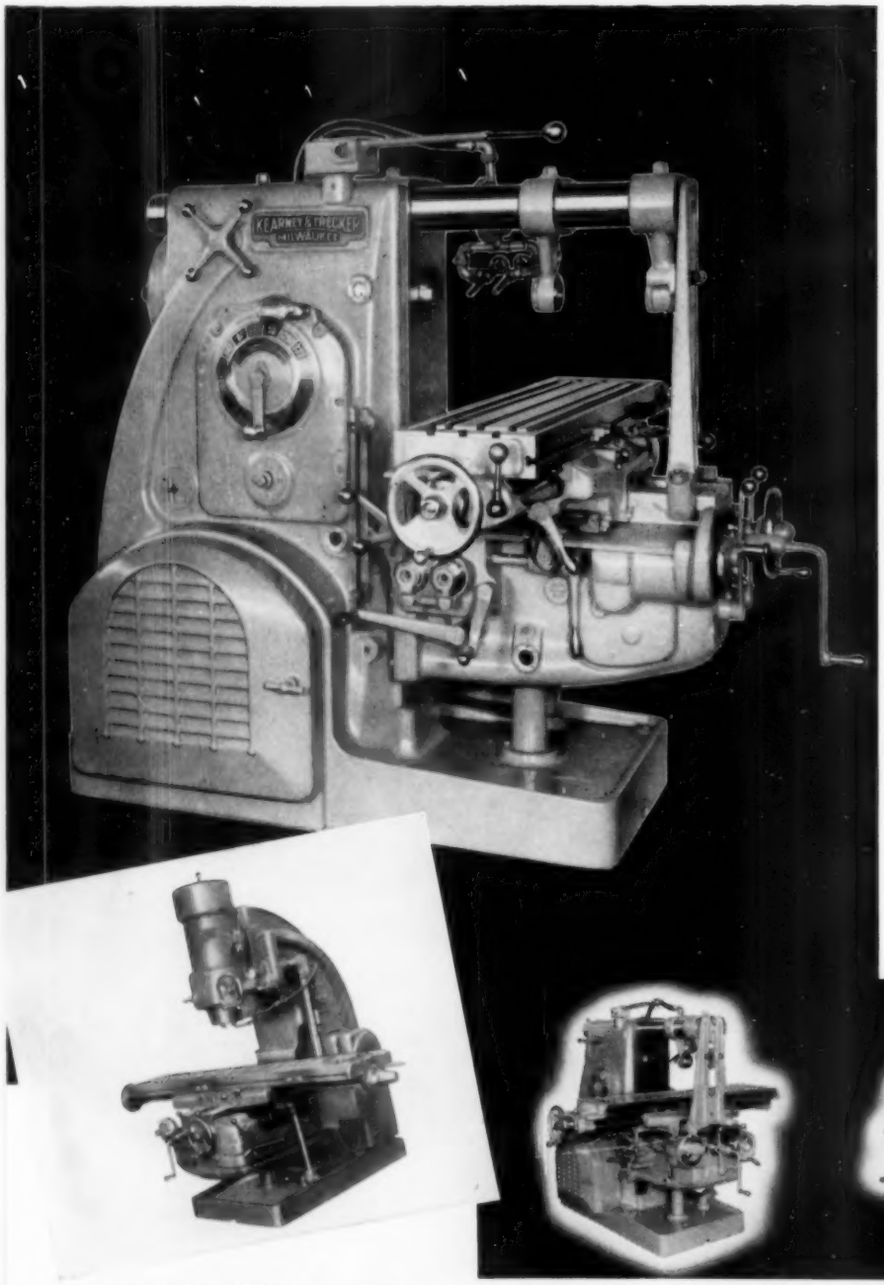
ANNOUNCING THE CSM's

. . . an outstanding addition to the Kearney & Trecker Milwaukee Line!



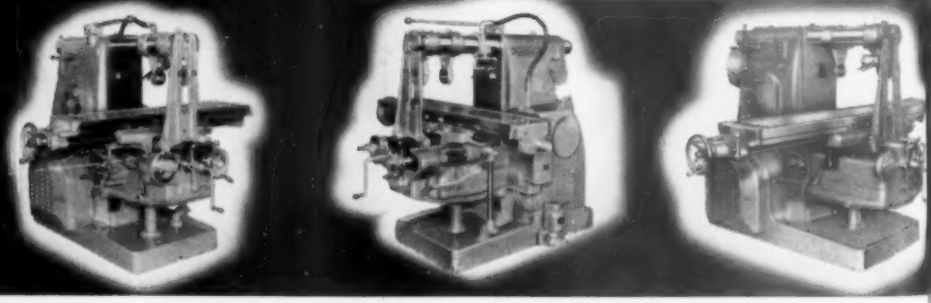
50 HP VERTICAL MODEL of the CSM Series shows outstanding efficiency and versatility of Kearney & Trecker design. Note the rugged column, the built-in flywheel, the accessible controls — insuring utmost productivity and accuracy on all jobs.

New Series of CSM Knee-Type Milling Machines Now Cuts Production Hours to Minutes Over a Wide Range of Jobs!

A complete series of CSM Machines, high powered for carbide milling of steel — machines that will handle regular milling jobs as well — this is Kearney & Trecker's latest contribution to modern milling equipment.

Pioneered and developed by Kearney & Trecker research engineers, the CSM machines embody the newest and finest in design and engineering features to meet the requirements of modern carbide milling of steel: 1) Solid-back column gives powerful support and rigidity to entire machine; 2) A large, heavy flywheel is an integral part of the spindle, and assures smooth, balanced flow of power to cutter from 20, 30, or 50 hp motor; 3) Wide range of speeds and feeds are carefully selected to match work requirements.

Time-tested operating and performance features of the famous Kearney & Trecker "K" Machines have also been included to give you the finest in up-to-date milling machine construction and operation. CSM Machines are available in both horizontal and vertical knee-type models. Write for descriptive catalog.



A complete series of power rated machines, in horizontal and vertical models, to meet your requirements.

20 CSM Horizontal—a 20 hp machine with 28″ or 34″ table travel.

30 CSM Horizontal—a 30 hp machine with 34″ or 52″ table travel.

50 CSM Horizontal—a 50 hp machine with 42″ or 52″ table trav

Write today for complete information on these New Machines

KEARNEY & TRECKER
CORPORATION
MILWAUKEE 14, WISCONSIN

Many standard PM plug, ring and thread gages are always in stock for prompt shipment. Prices and delivery dates on special equipment on request. Please write us.

Practical Precision for 1946 Production

During the past five years, the production industries have been called upon to maintain higher precision standards than ever before.

While some of these new standards may not be required for ordinary machinery in daily use, new methods and techniques will enable us to retain much of our newly-gained precision without paying a cost penalty.

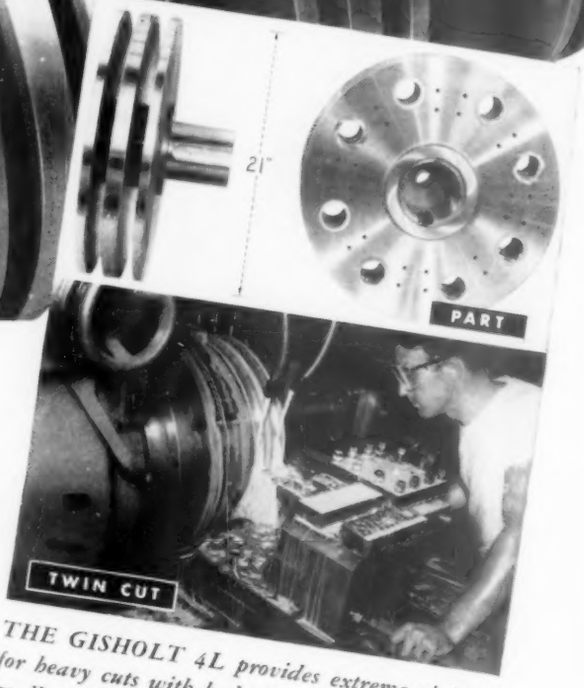
The result will be economies in assembly, plus improved performance and longer wear.

Gages made by Pipe Machinery, bearing the PM Diamond emblem, will help you establish and maintain any degree of accurate dimension called for in your plant.

ARMY E NAVY

The PIPE MACHINERY COMPANY Cleveland, O.

HOW TO MACHINE DEEP GROOVES on a STANDARD *GISHOLT* TURRET LATHE

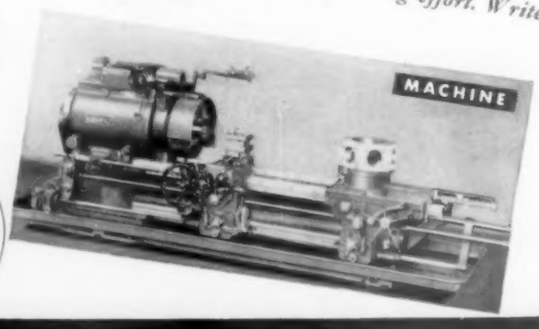


Here's an interesting example of extremely heavy machining done on a standard Gisholt 4L Saddle Type Turret Lathe. It indicates how many a job may be handled with equipment already on the floor and without changes in the base design of the machine.

Heat-treated steel forgings for 21″ diameter vibration dampeners for Diesel engines were machined from the solid, with simultaneous cutting of two grooves 7¼″ deep by 1-3/16″ wide. The only special attachment required on the Gisholt was an auxiliary tool holder and base to hold the long grooving tools. Roughing and finishing cuts were taken, holding to close tolerances for size and squareness, in a total cutting time of one hour and 29 minutes.

For those interested in complete details, some reprints of an article on this unusual job have been made available. Write for your copy.

THE GISHOLT 4L provides extreme rigidity for heavy cuts with bed and headstock cast integrally and thick block-type ways of hardened steel which support all bearing surfaces for heavy carriages. This large and powerful machine requires surprisingly light operating effort. Write for literature.

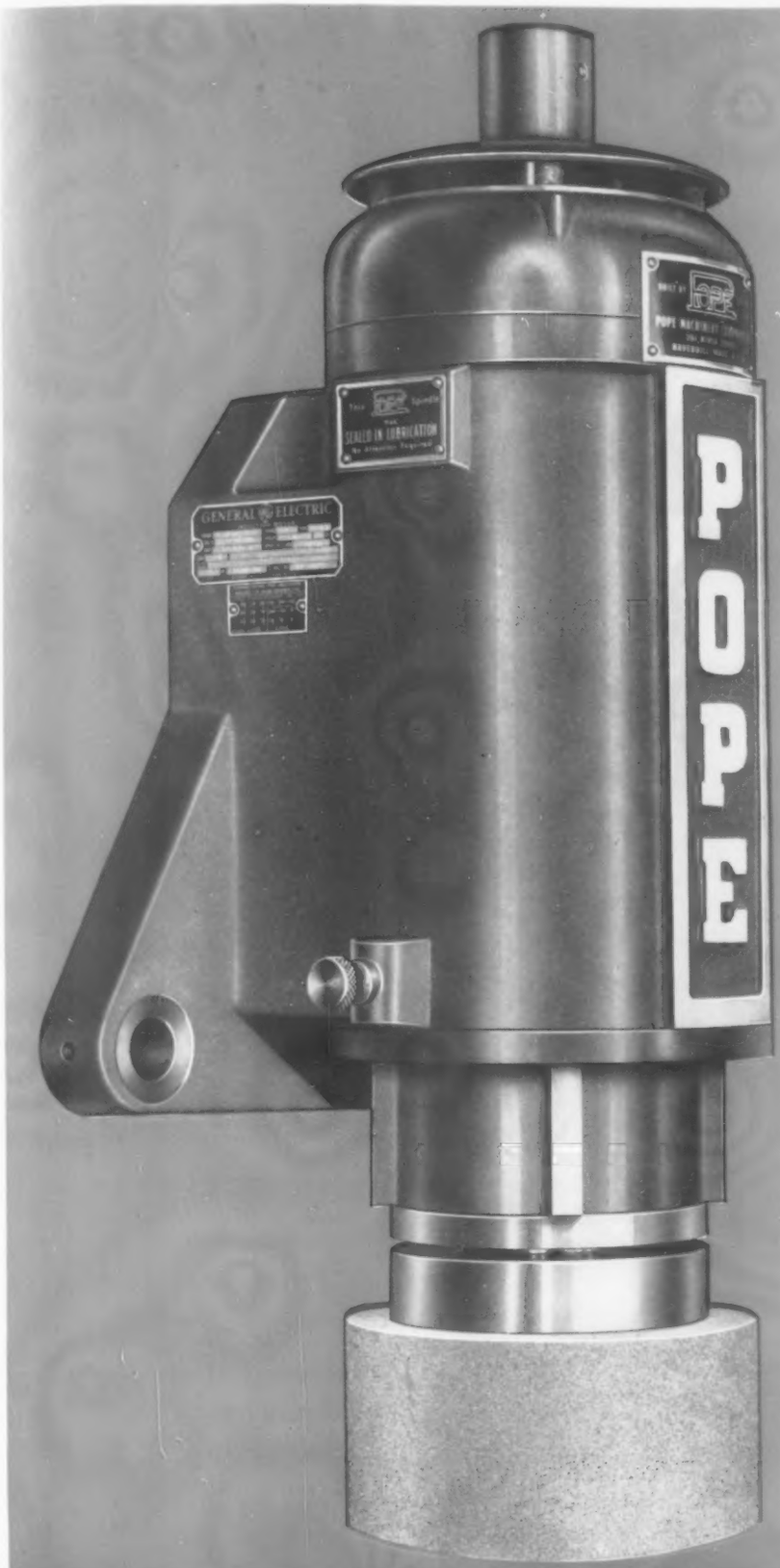


GISHOLT MACHINE COMPANY
1257 East Washington Ave. • Madison 3, Wis.

Look Ahead . . . Keep Ahead . . . With Gisholt Improvements in Metal Turning

GISHOLT

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES



Put This POPE VERTICAL MOTORIZED SPINDLE *On Your* GRINDERS

With sealed-in lubrication and totally enclosed fan cooled motor, this POPE Spindle has the power, the bearing capacity and the rigidity to rough off surplus metal fast. Its rugged ability to carry a heavy cut will also produce a better final finish.

Data sheets for 1200, 1800 and 3600 RPM and 3, 5 and 10 HP units are available. Tell us which one you want.

No. 32

POPE

POPE MACHINERY CORPORATION

ESTABLISHED 1920

261 RIVER STREET • HAVERHILL, MASSACHUSETTS

BUILDERS OF PRECISION SPINDLES

"BECAUSE MORSE TOOLS HOLD UP SO WELL, REPLACEMENTS ARE HELD DOWN TO A MINIMUM"

AS ALWAYS—THROUGH DISTRIBUTORS

Morse Tools make a substantial contribution to production efficiency and economy. For significant savings and better quality work, use Morse Tools.

MORSE THERE *IS* A DIFFERENCE

TWIST DRILL AND MACHINE COMPANY
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MORE ACCURACY AND FASTER TAPPING

This head will help you increase production. It cuts class three threads, or better, on long production runs.

Consider these exclusive features:

1. One head for rotating or stationary spindle machines —just remove handle and apply cover plate. Cuts down tool investment.

2. Simple construction—few parts—broad bearing surfaces—hardened and ground throughout—for longer life.

3. Blade-type ground thread chasers on sizes 1¼″ to 4″. Circular ground thread chasers on sizes 3″ to 5″.

4. Quick trigger-action collapsing. Easy diametric adjustment without removing head from holder.

Quicker—more productive—easier to operate—higher precision—smaller tool investment—longer life. Ask for Catalog D42 C.

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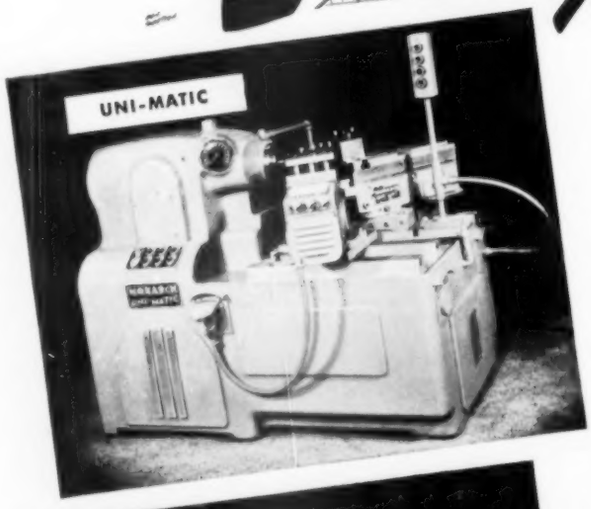
Acme-Gridley Bar and Chucking Automatics: 1-4-6 and 8 Spindle • Hydraulic Thread Rolling Machines • Automatic Threading Dies and Taps • The Chronolog • Limit, Motor Starter and Control Station Switches • Solenoids Centrifuges • Contract Manufacturing

Announcing 3 New Monarchs



These are Monarch's answers to the problem of how to meet rising production costs:

Each is unique—each is a radical improvement over conventional turning methods. For complete specifications call your nearest Monarch representative—or write us direct.

UNI-MATIC An automatic turning machine for chucking and fixture work—combines high production and extreme accuracy on turning, boring and facing operations. Broad range of spindle speeds up to 1000, 2000, 3000 and even 5000 rpm. Completely independent, electronically controlled action of each interchangeable Uni-Mat (a motor driven tool slide) permits universal positioning as well as universal tooling. Feed range ½″ to 13″ per minute, with rapid traverse of 100″ per minute. Suitable for work as small as 1″ and as large as 16″ diameter.

MONA-MATIC An automatic turning machine for between-centers work, offering the same degree of high production and extreme accuracy as the Uni-Matic. Complete range of spindle speeds up to 1000, 2000, 3000 and even 5000 rpm. May be operated fully automatic, fully manual or in any combination. Power feed and rapid traverse return on front carriage; rear carriage may be added as separate unit. Swing over bed—15″; swing over front slide—8″, over rear slide—7½″; travel of front slide—4″, rear slide—3½″

SPEED-MATIC A high production hand screw machine with power feed ram type turret, hand operated cut-off slide and preselected changeable spindle speeds—from 50 to 5000 rpm. Designed for maximum high production with extreme accuracy on lots of 25 to 500 or higher. Automatic electronic speed change through as many as ten stations insures using most efficient cutting speed for each operation. Feeds from .0005″ to .016″ per revolution. Collet chuck capacity ⅞″.

THE MONARCH
MACHINE TOOL CO.
SIDNEY, OHIO

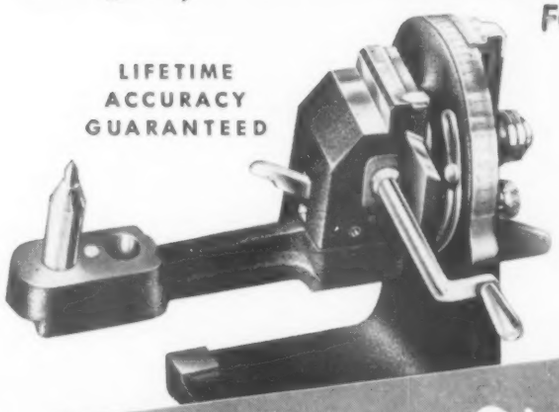
ACCURACY · ECONOMY · LONG LIFE

Monarch
TURNING MACHINES

Bley CONTOUR DRESSER

FOR SHAPING GRINDING WHEELS

LIFETIME ACCURACY GUARANTEED



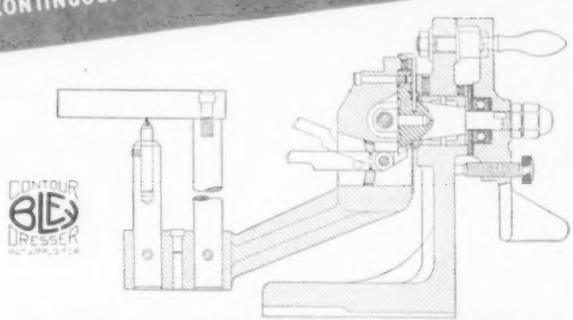
FOR ABSOLUTE PRECISION IN THE FORMING OF GRINDING WHEELS: ANGLES, RADII AND THEIR COMBINATIONS AND PERFECT BLENDING OF RADII WITH TANGENTS . . .

TYPICAL FORMS MADE ON A SURFACE GRINDER, WITH BLEY CONTOUR DRESSER WITH ARROWED LINES SHOWING EXTENT OF CONTINUOUS TRAVEL WITHOUT A CHANGE OF SET-UP.

The unparalleled accuracy of the Bley Contour Dresser is assured by these exclusive PATENTED features: (A) The sectional taper bearing, controlling all motion for radius work. (B) The lock-gib-adjustment, provided with floating screw feed for all angular passes. And (C) The center lock lever which centers the carriage for perfect tangent blending. All are adjustable not only to .0001" but to "no play." Consider these advantages carefully—then consider these other outstanding features:

1. Screw feed for angular passes — the only accurate control (no rack and pinion—no swiveling).
2. Fast, simplest to set up—easily maneuverable, sturdy, chatterless and dustproof.
3. Every functional part has compensating adjustment for lifetime accuracy.
4. Capacity: 3" male and 3" female radii up to 14" wheel, 2" angular travel.
5. Shapes wheel at its working surface.

A UNIQUE RECONVERSION VALUE OUT-PERFORMING OLD-STYLE MACHINES COSTING 3 TIMES AS MUCH



BLEY CONTOUR DRESSER

WITH 9 DIAMOND TOOLS

90° GOLCONE shaped point	$ 3.50
60° GOLCONE shaped point	4.00
CRYSTAL point	3.50
ELONGATED natural point	5.00
Rattail Tools For Semi-Circular Radii	
1/2" Rattail, radii from 0.250"	$ 7.50
1/4" Rattail, radii from 0.125"	7.50
1/8" Rattail, radii from 0.060"	5.00
3/32" Rattail, radii from 0.040"	7.25
1/16" Rattail, radii from 0.030"	8.50
	$51.75

6 EXTENSION SLEEVES and
1 RATTAIL TOOL ATTACHMENT
ALL FITTED IN FINE HINGED WOOD INSTRUMENT CASE

PRICED COMPLETE
$207.50

GOLCONDA DIAMOND PRODUCTS CORP.

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Distributors: A few highly desirable territories still available

Triple-alloy steels containing Nickel offer designers the following *triple* advantages:

1. OUTSTANDING PERFORMANCE—Strength and toughness, resistance to wear, fatigue or shock to meet a wide range of requirements, as dictated by design.
2. RELIABILITY—based on consistently uniform response to heat treatment.
3. ECONOMY—resulting from standard compositions precisely graded to match the engineers' needs.

Service records established by triple-alloy steels over a period of years show that they are giving excellent results in many diverse and exacting applications.

The large number of standard compositions available, including the 4300, 8600, 8700, 9300 and 9800 series, permit accurate and economic selection for specific uses.

Because of their many advantages, these triple-alloy steels warrant your careful consideration when planning new or improved designs. We shall be glad to furnish counsel and data upon request.

THE INTERNATIONAL NICKEL COMPANY, INC. 67 Wall Street New York 5, N. Y.

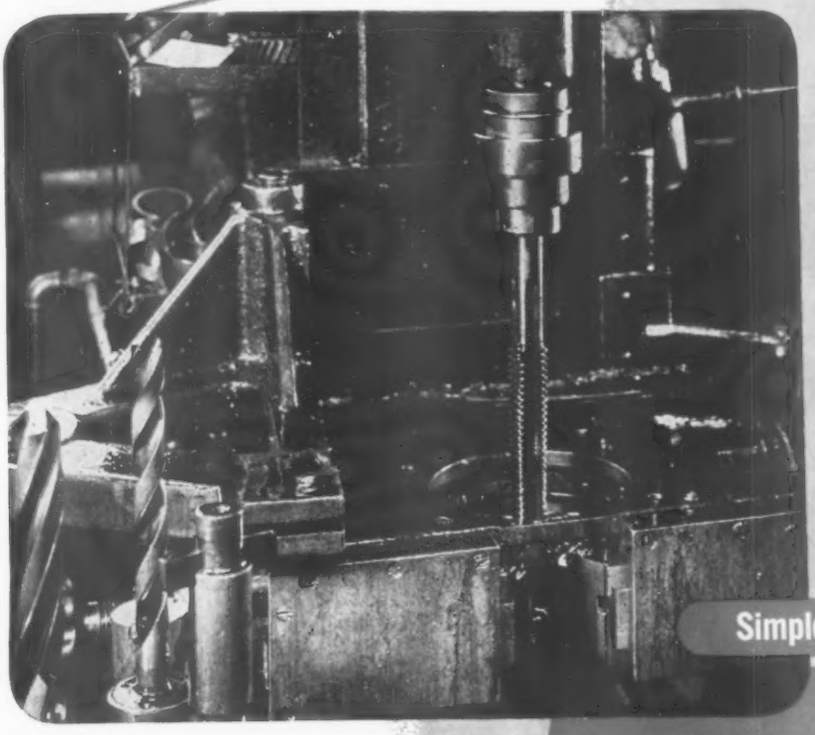
52 Pieces per Hour!

BESLY TAPS

Help to Set New Production Records on Nuts for

Simplex

Steamboat Ratchets



Above: Templeton, Kenly & Co.'s special drill press with lead screw for tapping. Pneumatic-powered fixture is in open position. Note different size drills on bench at left, used on same equipment for drilling nuts before tapping.

At right: Type L steamboat ratchet pulling jack. Nuts measure 2¼" (diameter) by 2½" (long). Two are used in each jack.

At one pass Acme form Besly Taps thread the large cold rolled steel nuts used in Simplex steamboat ratchet pulling jacks manufactured by Templeton, Kenly & Co., Chicago. A special drill press with self-contained lead screw is employed. Previous conventional methods required two or three passes.

Tap is 1½", 4 Acme thread. An important saving in labor costs is obtained . . . established tolerances are met.

Out of their experience in working with the technical experts in many industries, Besly engineers may be able to point out similar opportunities in your own tapping operations. Ask your Besly distributor for information, or write us today.

NOW . . .
in the Second Edition

Write for your copy of this valuable Tap Manual today! It contains valuable facts on taps, tap fits, and tapping procedures. You'll find it helpful in selecting the right tap for every job.

BESLY

BESLY TAPS • BESLY TITAN ABRASIVE WHEELS
BESLY GRINDERS AND ACCESSORIES

CHAS. H. BESLY AND COMPANY, 118-124 N. Clinton St., Chicago 6, Ill., Factory: Beloit, Wis.

Capacity . . .

MARVEL 18 *for Size,* MARVEL 6A and 9A *for Volume Production*

With this battery of twelve No. 6A and No. 9A MARVEL High Speed Automatic Hack Saws, the Hammond & Irving Forge Co. of Albany, New York, can cut off billets automatically, not only in tremendous numbers, but in accurate weights and sizes to exactly fill each die without waste. With 12 of the "world's fastest cutting-off saws," they were able to keep all hammers running on their tremendous war orders, and were able to instantly resume peacetime manufacturing without re-tooling or other delay. The No. 6A and No. 9A MARVEL automatics have capacities of 6" x 6" and 10" x 10" respectively.

In addition to the battery of MARVEL Automatics, Hammond & Irving have cutting-off capacity of a different sort in their MARVEL No. 18 Hydraulic Hack Saw—capacity for size because this roll-stroke giant cuts off billets and bars in sizes to 18" x 18" cross section. It easily handles the toughest and hardest steels.

ARMSTRONG-BLUM MFG. CO.
"The Hack Saw People"

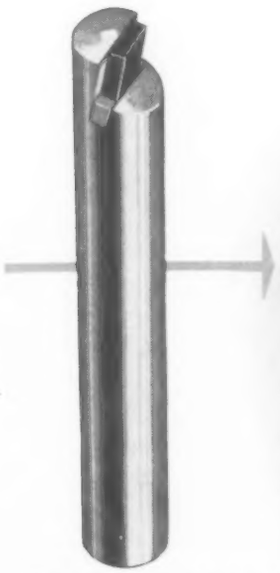
5700 Bloomingdale Ave. Chicago 39, U.S.A.

Eastern Sales Office: 225 Lafayette St., New York 12, N. Y.

A NEW ONE! THREADING TOOL

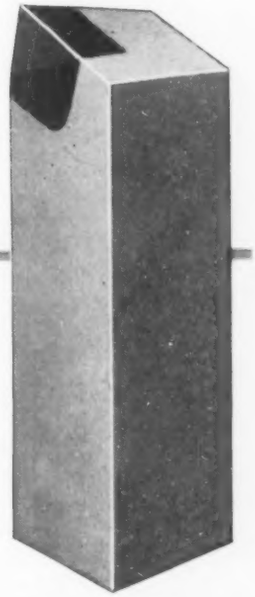
Now standardized at economy prices, this 60° Threading Tool, Style T-15, is stocked in 4 sizes at 95c to $2.40 each. Try it for greater accuracy, finish and savings on your threading jobs.

Try these OTHER *low cost standards*



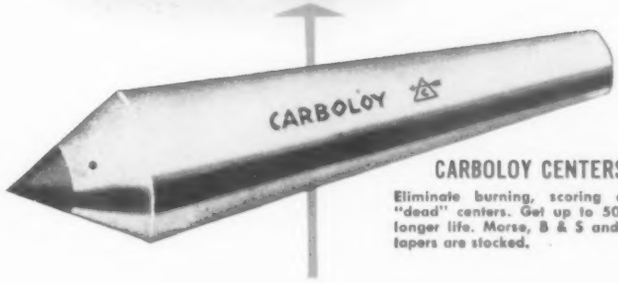
PRECISION "BORING" TOOLS

For high speed finishing to extremely close tolerances and "mirror-like" finishes. Stocked in "master" styles, ready to grind to suit. Priced as low as 45c each.



FOR ROLLER TURNERS

Full line of "box" tools for W & S, Gisholt, J & L or Acme lathes. Insure uniform, smooth size and finish, fast stock removal, extra long tool life.



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Eliminate burning, scoring on all "dead" centers. Get up to 50 times longer life. Morse, B & S and Jarno tapers are stocked.

For maximum savings from carbide tool use, don't overlook these "special-purpose" standards. They're designed to give you the same top-quality results at the same low cost as Carboloy's well known standards for general purpose turning, facing, boring.

It pays to specify Carboloy "Standards." They're quantity-produced at economy prices . . . planned to provide for diversified use from minimum inventories . . . quickly available from local stocks in 45 cities, coast to coast. Write for Catalog GT-175R.

CARBOLOY COMPANY, INC., **11124 E. 8 Mile Street • Detroit 32, Michigan**

CHICAGO • CLEVELAND • DETROIT • HOUSTON • LOS ANGELES • MILWAUKEE • NEWARK • PHILADELPHIA • PITTSBURGH • THOMASTON

STOCKED BY AUTHORIZED CARBOLOY CEMENTED CARBIDES DISTRIBUTORS IN 45 CITIES COAST TO COAST

Standard CARBOLOY (TRADEMARK) CEMENTED CARBIDE TOOLS

HOW TO GET BRASS MILL PRODUCTS!

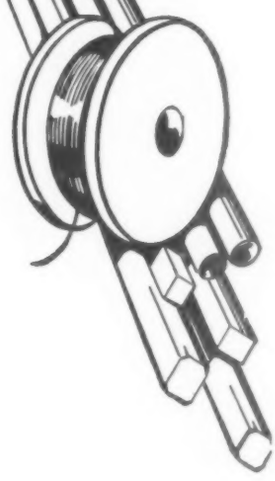
BRASS, BRONZE AND COPPER... Rod, Bar, Sheet, Strip, pipe, tubing, and wire in Production Quantities.

GOVERNMENT-OWNED SURPLUS STOCK

in many standard and non-standard grades, finishes, sizes and specifications AVAILABLE NOW in production quantities

—and new surplus declarations are being made daily.

EASY TO FABRICATE . . . This stock may be fabricated by normal production methods.



HOW TO PURCHASE

1. Estimate, for any convenient period, your production needs in each specification, finish, gauge, etc.
2. Write, wire or phone that information to your nearest War Assets Corporation office* below. We will advise you of the location and condition of the stock you need, estimate possible delivery dates, quote prices and help arrange credit.
3. When satisfactory arrangements have been made, we will start shipments.

***WAR ASSETS CORPORATION** is a Reconstruction Finance Corporation subsidiary. When checking telephone and other directories, simply look up RFC.

VETERANS OF WORLD WAR II: To help you in purchasing surplus property from War Assets Corporation, a veterans' unit has been established in each of our Regional Offices listed below.

A DISPOSAL AGENCY DESIGNATED BY THE SURPLUS PROPERTY ADMINISTRATION for Surplus Producers' and Capital Goods, Aircraft and Plants formerly handled by Reconstruction Finance Corporation . . . and for Surplus Consumer Goods formerly handled by United States Department of Commerce.

WAR ASSETS CORPORATION

(A SUBSIDIARY OF RECONSTRUCTION FINANCE CORPORATION)

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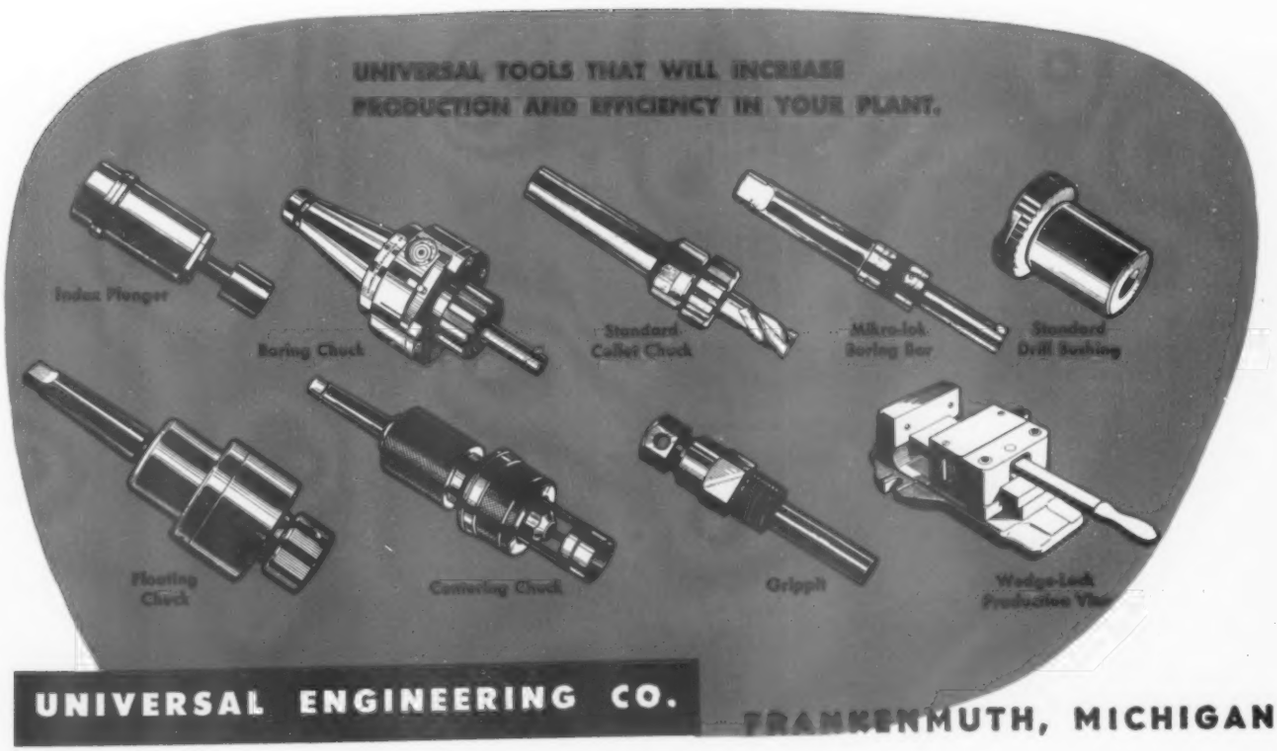
157-4

UNIVERSAL BORING CHUCKS

RIGID, CONVENIENT, PRECISION PERFORMANCE ON MILLING MACHINES, BORING MILLS, TURRET LATHES

Universal Boring Chucks simplify precision boring operations with boring mill, milling machine, and turret lathe. Bar held in the standard Universal collet giving solid grip of bar. Convenient resetting dial for anti-backlash feed screw, positive slide lock will repeat sizes within .0002" tolerance. Center reference button for bringing collet to dead center allows centering and drilling to precede boring operation. Universal Boring Chucks can also be used in lathes for turning and drilling eccentric parts. All wearing parts are hardened and ground, and the entire operating mechanism is fully enclosed to keep out dirt and chips. Available in straight or taper shank to accommodate bars from ⅜" to 1". For faster, more accurate, more dependable boring operations, it will pay you to make Universal Boring Chucks standard equipment in your plant. Write for complete information.



UNIVERSAL ENGINEERING CO. FRANKENMUTH, MICHIGAN

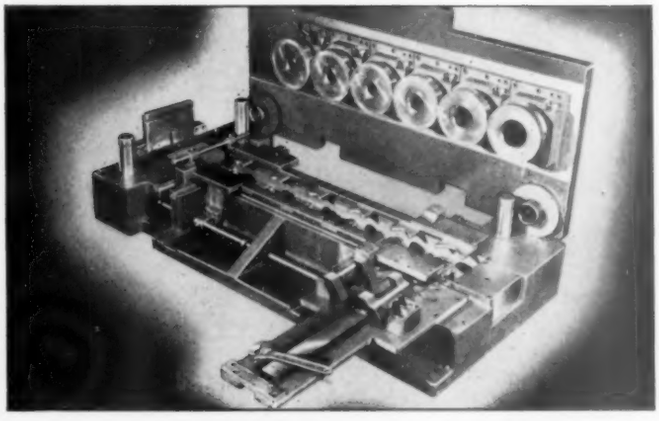
STEP by STEP *a cup grows deeper and deeper*

A demonstration of Olofsson skill is to be seen in this picture of a progressive draw die just completed in our shop. We are proud of the fine workmanship our men have put on this exceptional job.

The blanks are loaded into the die manually through a hopper which distributes them by an automatic mechanism, locating each blank in the first draw position. Mechanical transfers feed them progressively through the six reducing stations.

At each stage the cup being formed grows in depth, while its diameter diminishes. Through the skillful design and construction of this die the metal maintains its proper structure as it is cold-drawn to shape.

Olofsson welcomes such jobs because they require the highest degree of skill known to the die-making industry.



Olofsson

TOOL AND DIE COMPANY
LANSING, MICHIGAN

CHICAGO ENGINEERING OFFICE—600 SOUTH MICHIGAN AVENUE

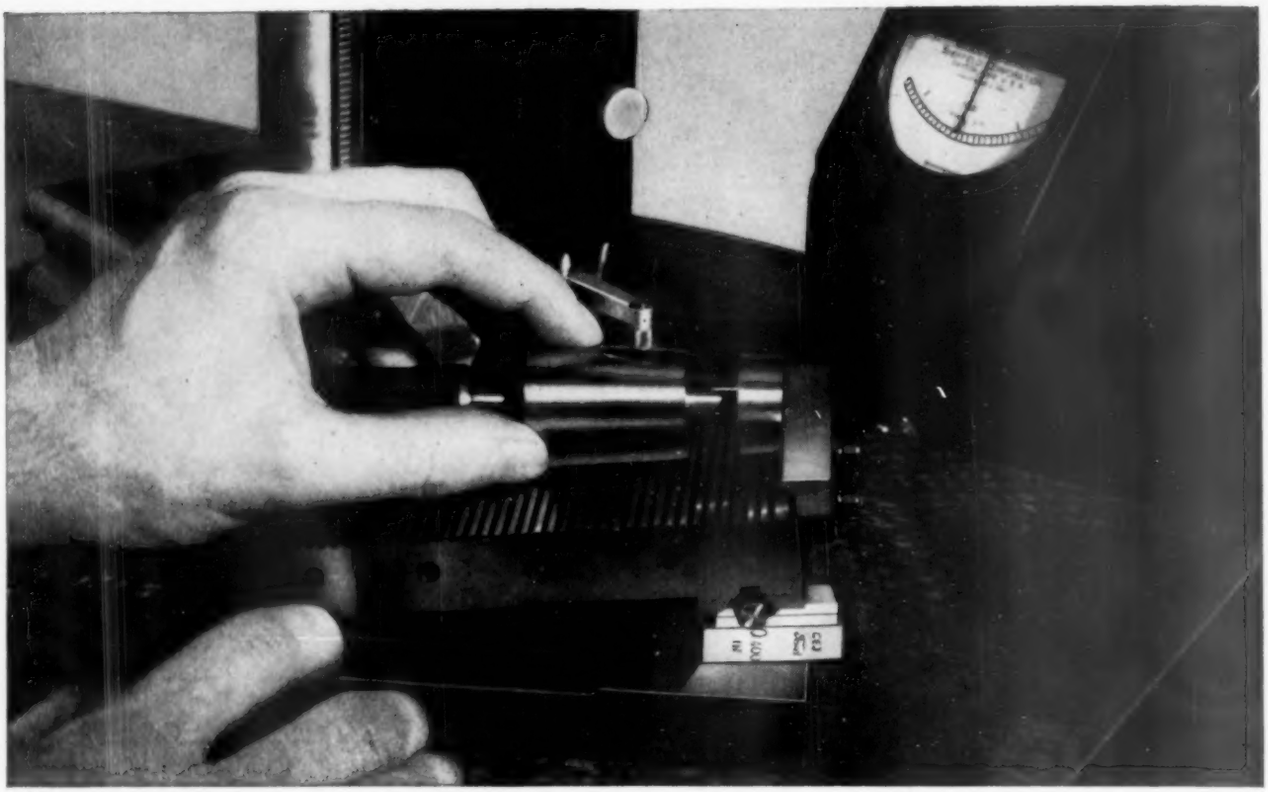
SIMONDS Red Tang FILES

...they keep your File-Costs down

RED TANG FILES have the same basic tooth-design as Simonds Metal-Cutting Saws. So Red Tangs *cut,* instead of *scrape* . . . remove more metal with less elbow-grease. That's why workers like them. *And here's why YOU will like them:* They last longer . . . and deliver more and better work per file-dollar. Order Simonds Red Tang Files from your Industrial Supply Distributor, or from the nearest Simonds office listed below.

SIMONDS SAW AND STEEL CO.
FITCHBURG, MASS.

BRANCH OFFICES: 1350 Columbia Road, Boston 27, Mass.; 127 S. Green St., Chicago 7, Ill.; 416 W. Eighth St., Los Angeles 14, Calif.; 228 First St., San Francisco 5, Calif.; 311 S. W. First Avenue, Portland 4, Ore.; 31 W. Trent Avenue, Spokane 8, Washington; *Canadian Factory:* 595 St. Remi St., Montreal 30, Que.



a ten-thousandth is routine . . . where JO-BLOCKS control by *millionths!*

It PAYS to control parts-dimensions to close limits. It pays in ease of assembly, in product performance and in the assured fit of replacement parts. In wartime, it paid richly in human lives saved. JO-BLOCKS, the pioneer precision controls, produced in America by Ford Motor Company only, for all industry, are warranted accurate to .000002", .000004" or .000008" ±, and are available in sets at $23 and upward, or in individual blocks, with various accessories. With properly selected genuine Jo-Block equipment, accuracy control can be maintained to the highest practical degree over the working gages required for any mechanical dimensional inspection.

FREE—NEW CATALOG!

Profusely illustrated, with full details, covering selection, application and care of Jo-Blocks. Write Ford Motor Co., Johansson Division, Dept. 416, Dearborn, Michigan.

Ford Johansson GAGE BLOCKS

Tool Steels

FOR SPECIAL PURPOSES*

SILMAN	Shock-Proof Steel with high wear resistance. Use for heavy duty requirements,—punches, chisels, hot or cold shears, slitting cutters. The Nation's choice for carbide tool shanks.
PAR-EXC	Low Tungsten steel of exceptional strength and toughness for heavy duty punches, chisels, hot headers, embossing and forming dies. For all tools and dies subject to breaking from shock and bending stresses.
NIKRO M	Chrome—Nickel—Molybdenum tool steel having high strength and toughness at high hardness. For forming and shearing dies, embossing dies, slitters, saws, plastic moulds, coining dies, feed screws, spindles.
CM	Tool maker's grade—oil hardening steel providing tough core in sizes over 3/4" round. For taps, chasers, rethreading dies, drills, reamers, broaches, arbors, drill jig bushings.
CROMAN	Tool maker's grade of oil hardening steel. Hardens to Rockwell C 67 in any size. Uses similar to CM.
COLHED	Contains 1.00 Carbon—.50 Vanadium. Can be quenched from temperatures as high as 1800°F without grain growth. Case depth regulated from very shallow to deep by varying quenching temperature. Particularly useful for special cold heading applications.

*One of the series of six Vasco Tool Steel Classifications covering every industrial requirement.

All of the above steels are available in billets, bars, hot rolled or cold drawn shapes, solid forgings, ring forgings, sheet, plate, circles, and drill rod.

VANADIUM-ALLOYS STEEL COMPANY

First Quality Tool Steels

Latrobe, Pennsylvania

CAMPBELL ABRASIVE CUTTING MACHINES ARE PRODUCTION MACHINES

THEN...
IT TOOK 6 HOURS PER 1000 PIECES TO CUT THIS SLOT
NOW
IT TAKES 1 HOUR PER 1000 PIECES TO MAKE THE SAME CUT
HERE
IS THE CAMPBELL "AUTOCUTTER" (FULLY AUTOMATIC) THAT INCREASED PRODUCTION BY
6 TO 1

CAMPBELL MAKES A FULL LINE OF ABRASIVE CUTTERS

Send for your copy of this file-size catalog folder. Ask for DH-1315.

Campbell machines have been developed far beyond the simple function of cutting off materials. The job shown above, for example, is but one of many in which abrasive cutting is supplanting other conventional machining methods—speeding up and economizing production. Write for detailed information.

ACCO

TRADE MARK

ALSO MAKERS OF A COMPLETE LINE OF NIBBLING MACHINES

ANDREW C. CAMPBELL DIVISION
AMERICAN CHAIN & CABLE • BRIDGEPORT, CONN.

GET MACHINING COSTS DOWN
. . . with TECO Cemented Carbide!

Any one of the above advantages would reduce your present cost of machining with carbide. You get *all four* with TECO, to bring your machining costs down to rock bottom. Teco Cemented Carbide combines hardness, toughness and breakage resistance to a degree never before obtained in a cutting material. It holds a cutting edge longer and produces far more work than any similar material.

Prove it yourself! Replace your present carbide tools on any job, with harder, more uniform TECO. Then check the output. TECO performance is a revelation in low-cost, high-speed production.

Teco Cemented Carbide Tools in standard shapes, grades and sizes are in stock for immediate shipment.

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TUNGSTEN ELECTRIC CORPORATION • 570 39th Street
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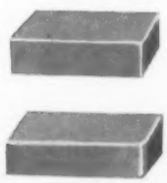
Branch Office: 403 Western Reserve Bldg., Cleveland 13, Ohio
Representatives: Indianapolis, Ind., Chicago, Ill., Detroit, Mich.

TECO CEMENTED CARBIDE BLANKS



Immediate delivery on full range of standard sizes, grades and styles.

TECO
CEMENTED CARBIDE
Pioneers in Tungsten Carbides for over a Quarter Century

SAWING
FILING
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GROB
BROTHERS
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these MO-MAX high speed steels

"LMW"	ALLEGHENY LUDLUM STEEL CORP.
"MOHICAN"	ATLAS STEELS LIMITED
"BETHLEHEM HM"	BETHLEHEM STEEL COMPANY
"MO-CUT"	BRAEBURN ALLOY STEEL CORP.
"STAR-MAX"	CARPENTER STEEL COMPANY
"MOLITE M-1"	COLUMBIA TOOL STEEL CO.
"REX T-MO"	CRUCIBLE STEEL CO. OF AMERICA
"DI-MOL"	HENRY DISSTON & SONS, INC.
"HI-MO"	FIRTH-STERLING STEEL COMPANY
"REX T-MO"	HALCOMB STEEL COMPANY
"MOGUL"	JESSOP STEEL COMPANY
"TATMO"	LATROBE ELECTRIC STEEL CO.
"S. T. M."	ST. LAWRENCE ALLOYS, INC.
"MO-TUNG"	SIMONDS SAW & STEEL CO.
"8-N-2"	UNIVERSAL-CYCLOPS STEEL CORP.
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assure BETTER performance of

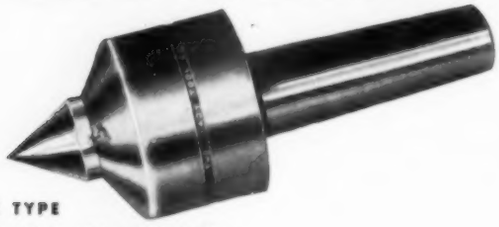
DRILLS • REAMERS • LATHE TOOLS • CUT-OFF TOOLS • TOOL BITS • MILLING CUTTERS • HOBS • CIRCULAR SAWS • THREAD ROLLING DIES • COUNTER-BORES • BROACHES • LATHE CENTERS • SPOT FACERS • CIRCULAR AND FLAT FORMING TOOLS • DIES FOR BOTH HOT AND COLD WORK • TAPS • THREAD CHASERS, ETC.

For the full story on MO-MAX high speed steels—their physical properties, their advantages, and how to heat treat them—write today to Department D for the new, revised MO-MAX Handbook.

THE CLEVELAND TWIST DRILL CO. • 1252 East 49th St. • Dept. D • Cleveland 14, Ohio

CENTER Specialists since 1908

RED-E
NEW DEPARTURE BALL BEARING CENTERS



SHANK TYPE

Preloaded Precision Ball Bearings. Replaceable High Speed Points. Smooth, sustained high accuracy for all average service requirements.

BALL & ROLLER BEARING TYPE

Preloaded Precision Ball Bearings in head.
Precision Roller Bearings in shank.
Replaceable High Speed Points.
For sustained accuracy at high speeds and heavy feeds with carbide tools.

OUTSIDE of SPINDLE TYPE

Preloaded Precision Ball Bearings. Specified for heaviest duty and loads on large workpieces in railroad shops, etc.

Designed and built by CENTER SPECIALISTS who believe that a good center requires as competent engineering as the precision machine tools it will be used in. Write for Catalog No. E-46

THE READY TOOL CO.
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OTHER RED-E PRODUCTS YOU SHOULD KNOW...

CEMENTED CARBIDE TIPPED LATHE & GRINDER CENTERS with the RED-E Safety "Life Line"
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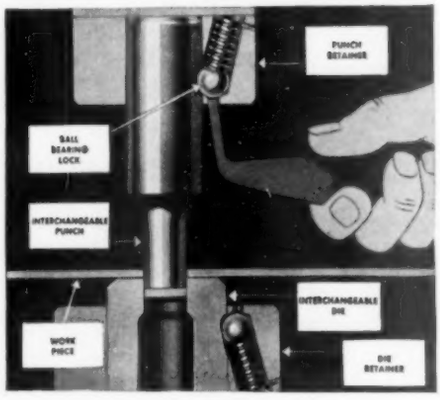
RED-E STYLE X LATHE TOOL with the Tool Steel Bearing
MILLING MACHINE & FACE PLATE DOGS
GRINDER DOGS

RED-E-TOOLS

Bulletins on any or all of these Products on request.

The Original
INTERCHANGEABLE PUNCH and DIE



Allied's R-B Interchangeable Punch and Die lowers costs in the metal working and plastic industries. Standard punches and dies carried in stock. Special shapes and sizes in any material made to your specifications with prompt deliveries. Send for large illustrated R-B catalog, now.

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Sensitive and VERSATILE

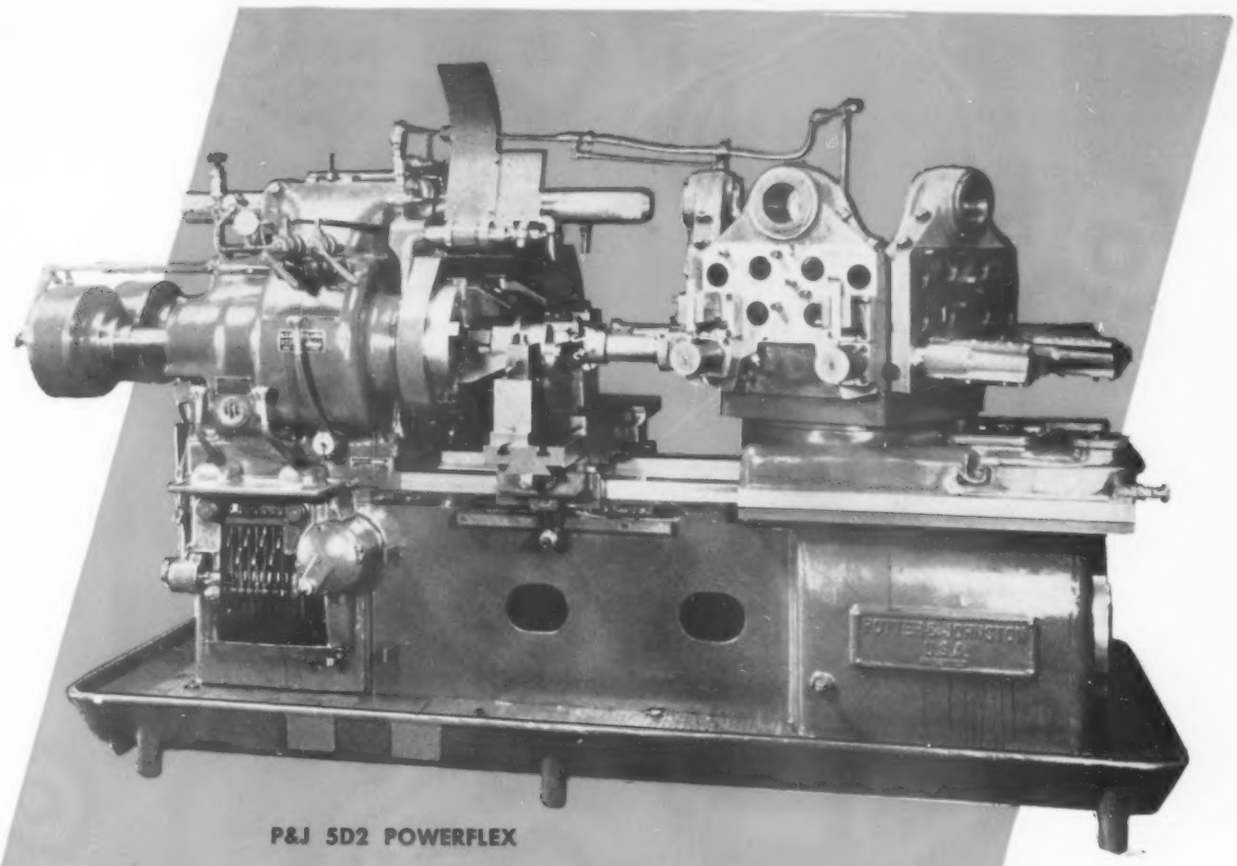
The Hamilton Varimatic Super-Sensitive Drilling Machine

If your production entails the drilling of small holes (.004" to 5/16" in all drillable materials) this machine was made for you.

With infinite variation of spindle speeds, in two ranges, between 840 R.P.M. and 9300 R.P.M., instantly available by the simple use of a hand wheel and graduated speed dial; with ample clearances and travel allowances, uncanny accuracy and convenience of operation, the sensitive and versatile Hamilton Varimatic will win your confidence in one day of operation.

Write for descriptive literature containing specifications and prices. Address Department F.

THE Hamilton TOOL COMPANY
SUPER SENSITIVE DRILLING MACHINES · TAPPING MACHINES · PORTELVATORS
NINTH STREET AT HANOVER · HAMILTON · OHIO · U·S·A



P&J 5D2 POWERFLEX

When You Need Greater Productive Capacity Than Is Possible With Single Spindle Machines

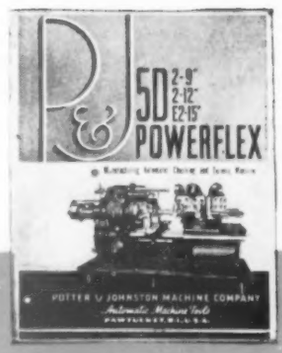
For any work within its range, the P&J 5D2 Powerflex assures an output per machine far in excess of that obtained with a single spindle unit. The 5D2 is the logical development of the single spindle 5D Model which long ago established its place among recognized high production machines.

Power and rigidity are offered in this machine as well as four automatic changes of spindle speed while under cut, three selective automatic changes of feed, automatic binding of turret following index, direct cross slide action and a constant high speed motion to cross slide and turret slide.

These and other outstanding features are fully described in Bulletin 120, available promptly on request.

• *Made in THREE MODELS as follows* •

	Cross Slide Travel	Swing over bed	Dist. between spindles	Turret faces
5D 2-9"	5"	21½"	10½"	5 or 6
5D 2-12"	5"	23"	15½"	5 or 6
5D 2-15"	5"	28"	15½"	5 or 6



Buy More Victory Bonds and Hold Them

POTTER & JOHNSTON MACHINE CO.

Providence, R. I.

IF YOU NEED HEAT TREATING EQUIPMENT NOW!

*...and cost is a major factor – take these * 3 steps . . .*

1* DETERMINE ACCURATELY YOUR OWN NEEDS

We can make it worth *your* while to determine for yourself the kind of equipment you need, its capacity, rating, etc. If you can give us accurately the limit conditions of your needs, we can almost certainly locate surplus low cost equipment to fit those conditions.

2* ESTIMATE THE COST YOU CAN AFFORD

Our principal objective is to get this equipment into *your* hands and actively producing urgently needed goods. In pricing, every consideration will be given to the necessary adaptations of the furnaces to your particular needs.

3* FILL IN AND MAIL THIS COUPON

ROTARY HEARTH
For heat treating in production operations. Semi-automatic operation and control.

TEMPERING FURNACE
For tempering small work in production or for the tool room or laboratory.

INDUCTION HARDENER
The latest development in controlled surface hardening by high frequency induction.

VETERANS OF WORLD WAR II

To help you in purchasing surplus property, veterans' units have been established in each War Assets Administration Regional Office.

To War Assets Administration: Please send me information on the following types of surplus Heat Treating Equipment.

FUEL	INTENDED USE	TYPE OR MAKE
☐ Electrical	.....	.....
☐ Gas	.....	.....
☐ Oil	.....	.....
☐ High Frequency Induction	.....	.....

I am also interested in ☐ heating furnaces, ☐ melting furnaces, ☐ dryers, ☐ kilns.

Name ..... tel. no. .....

Firm .....

Address .....

City ..... State 174-1

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OFFICES LISTED BELOW ARE TEMPORARILY IN RECONSTRUCTION FINANCE CORPORATION AGENCIES

Offices located at: Atlanta · Birmingham · Boston · Charlotte · Chicago · Cleveland · Dallas · Denver Detroit · Helena · Houston · Jacksonville · Kansas City, Mo. · Little Rock · Los Angeles · Louisville Minneapolis · Nashville · New Orleans · New York · Oklahoma City · Omaha · Philadelphia Portland, Ore. · Richmond · St. Louis · Salt Lake City · San Antonio · San Francisco · Seattle · Spokane Cincinnati · Fort Worth (Telephone 3-5381)

GREEN "GO"

RED "NOT GO"

REVOLUTIONARY NEW WOODWORTH THREAD RING GAGE

"It Starts round and Stays round with every adjustment!"

The new Woodworth Adjustable Thread Ring Gage offers many sensational improvements over those of conventional design.

Proven by actual tests to be mathematically round through the full range of adjustments, its revolutionary design permits a degree of accuracy in thread inspections never before obtained.

Step up your production — reduce your manufacturing costs—with this new Woodworth instrument of accuracy.

5-PLUS FEATURES

1. GREATER ACCURACY AND STABILITY
2. LONGER WEAR LIFE
3. LESS WEIGHT
4. POSITIVE IDENTIFICATION
5. POSITIVE ADJUSTMENT

ACCURACY YOU CAN TRUST

Wire or write for Folder No. 46R

WOODWORTH

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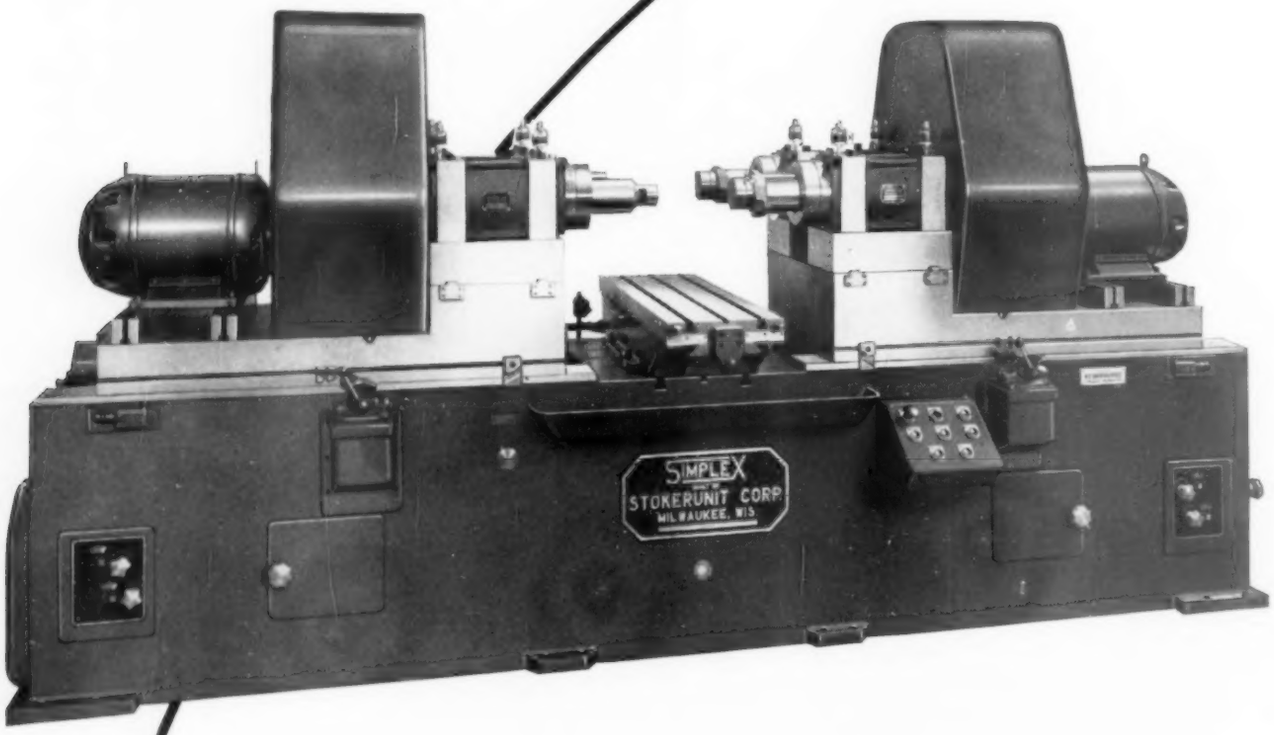
PRECISION GAGES • PRECISION MACHINE AND AIRCRAFT PARTS • DIAPHRAGM CHUCKS • ADJUSTABLE CLAMPING JIGS • SPECIAL TOOLS

SIMPLEX

Increasing wage rates of today make necessary new methods of reducing costs. At medium production rates, this becomes difficult with general purpose machine tools. Simple multiple tooling and fixtures, indexing from roughing to finishing position, offer a new cost reduction method. Tooling costs are low — job possibilities endless.



This photograph shows a SIMPLEX 4U 2-way Precision Boring Machine equipped with four #4 spindles and a hydraulically indexed sliding table operating between adjustable positive stops. On the sliding base a single work holding fixture is mounted providing for operating on the work from both ends. After the roughing operation is completed on both ends, the table is indexed to the finishing position, the finishing operations are performed on both ends simultaneously and the completed job is ready to remove from the fixture to change to the next job. The fixture and tools are removed and retained intact, ready for a quick set-up when the job is again run. The automatic cycle relieves the operator and helps maintain predetermined production schedules.

Precision Boring Machines

STOKERUNIT CORPORATION

SIMPLEX Machine Tools Division

4528 West Mitchell Street, Milwaukee 14, Wisconsin

Precision Boring Machines, Planer Type Milling Machines and Special Machine Tools

NOW AVAILABLE..Production Tested...

haskins NEW ALL-PURPOSE TAPPING MACHINE

Electric-Air Control is standard equipment on the new Haskins high speed tapping machines. Completely redesigned, these fully universal machines provide every conceivable method of control and allow free interchange of any type of holding fixture—hand fed or automatic.

Electric-Air increases sensitivity in the application of power, permits accuracy in depth of stroke, satisfies the most exacting requirements. Solenoid valves offer automatic or controlled cycle of operation, allow the synchronizing of holding fixtures with the stroke of the tap head.

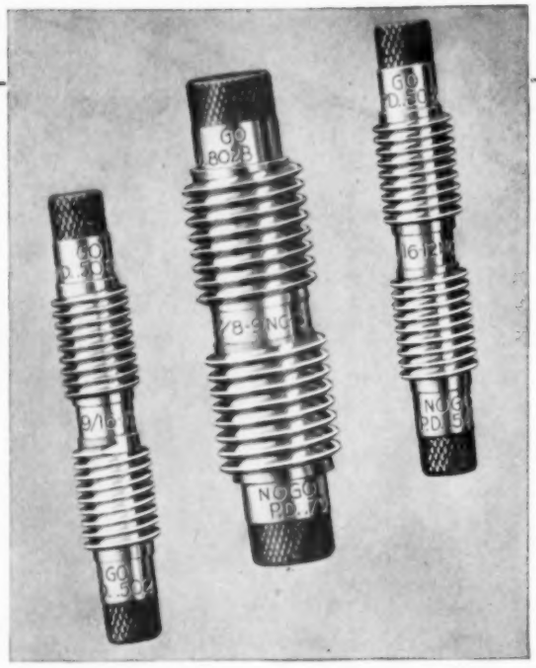
All in all, the Haskins Electric-Air Controlled Tapper is certain to become a most important development in modern tapping history. Send for details.

And, in addition, a new heavy duty machine.

R. G. HASKINS CO. • 2741 W. Flournoy St. • CHICAGO 12, ILLINOIS

HASKINS

haskins ELECTRIC - AIR CONTROLLED TAPPING EQUIPMENT



THRED-MASTER

Saves TIME AND EQUIPMENT

Each THRED-MASTER consists of a go and no-go section combined in a progressive type gage with knurled handles.

Being round, the THRED-MASTER presents an infinite number of measuring contact points which means greater gaging-life. THRED-MASTERS are made to "Master" gage accuracy and conform to N.S.T.C. standards.

They are easy to use:—Pick out the THRED-MASTER and corresponding measuring wires of the proper size. Set up your amplifier directly by the three wire measuring system.

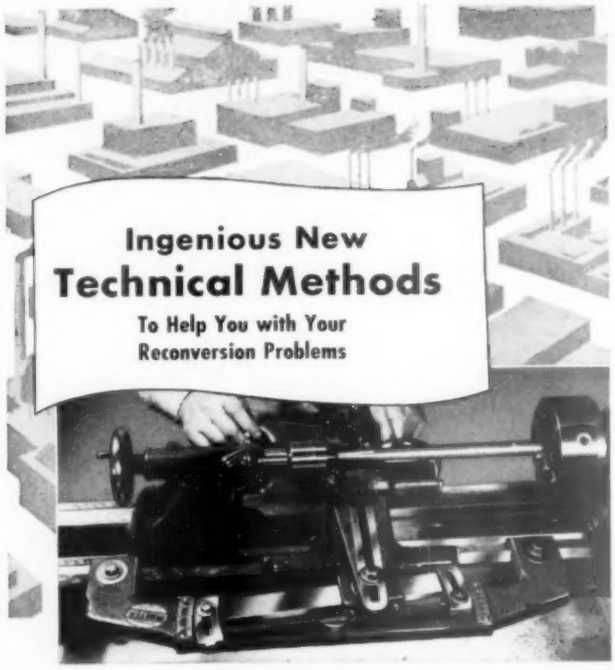
These measuring standards are ideal for setting up amplifiers (either visual or electric) and for accurately adjusting roll thread snap gages.

Write for price and delivery.

REPUBLIC GAGE

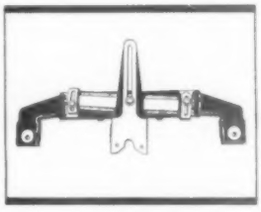
2228 PENKELL AVE. DETROIT 21, MICH.

PHONE UNiversity 1-0370



Simplified Master Taper Attachment Fits All Types of Lathes Instantly!

Now! A "universal" taper attachment that fits all lathes, old or new, big or small—that can be attached or removed in *minutes!* This taper attachment is not bulky or cumbersome. It bolts easily to the bed, in the back of any lathe.



Model 710
Master Taper Attachment

The Master performs accurate taper turning, boring and threading with the ease of any straight line tool operation. It precisely duplicates any tapered part. Is usable in any position. Does not interfere with straight turning. The bar is precisely machined and fitted. There is no vibration. Taper graduations are in inches at one end; degrees at the other. The master is available now, in two sizes; two feet and four feet in length.

Available today also, is delicious Wrigley's Spearmint Gum. This is one treat you can enjoy even when your hands are busy. And the pleasant chewing helps to keep you alert and wide-awake, even through a monotonous job.

Chewing Wrigley's Spearmint satisfies a fellow. In addition, it helps keep your mouth moist and fresh—so you feel better. And feeling better, you naturally work better. By making gum available to all, scores of plants and factories report increased morale and efficiency that really pays off.

You can get complete information from the Keene Electrical Machinery Co., 549 W. Washington Blvd., Chicago 6, Ill.

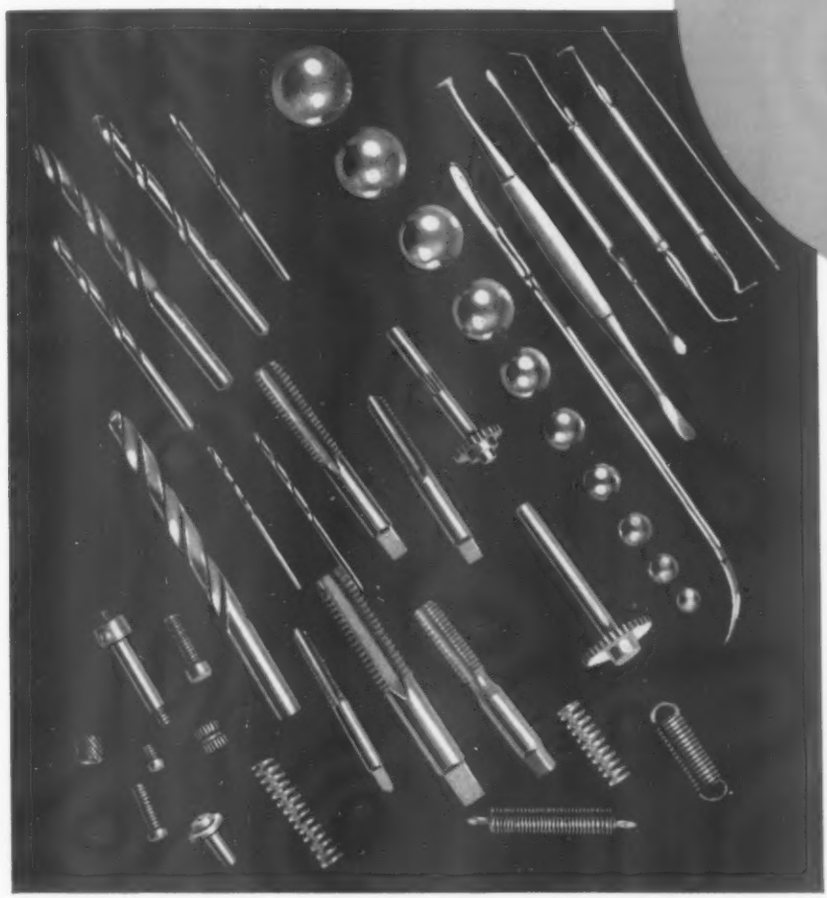
AA-64

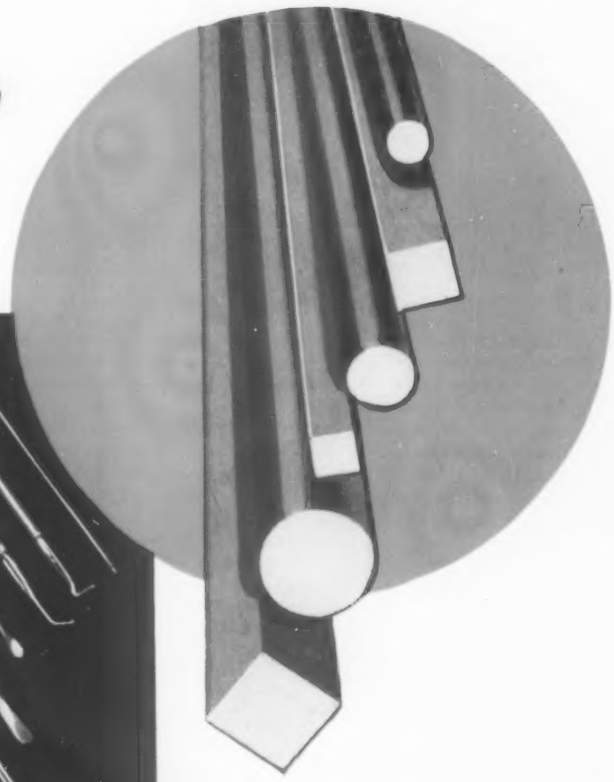
GLOBE DRILL ROD

a

FIRTH STERLING

Product





Available in High-Speed Steels, Tool Steels, Stainless Steels—in Bar, Rod and Wire. It is supplied in various finishes—polished, ground, and rough drawn or rough ground. "A Uniformity of High Quality."

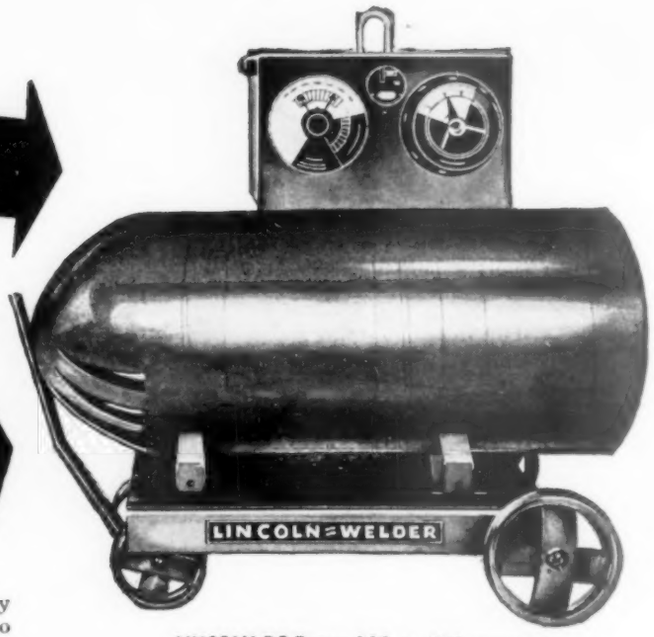
GLOBE WIRE DIVISION

Call **Firth-Sterling**

STEEL COMPANY

McKeesport, Pa. • New York • Hartford • Philadelphia • Pittsburgh • Cleveland • Dayton • Detroit • Chicago • Los Angeles

SURPLUS ARC WELDERS

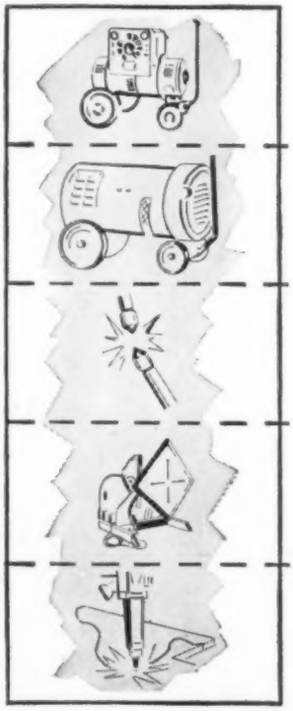


LINCOLN DC Type: 300 to 400 amperes

This and many other types and makes of welding machines and related equipment are available from war surpluses.

Here is a chance to pick up arc welding equipment in any desired quantity at low cost. Large quantities of 300 to 400 ampere MG type welders—primarily of Lincoln and Hobart make—are available for sale. Largest inventories are in the Boston, Detroit, Cleveland, Chicago, Atlanta, Nashville, Houston and Philadelphia offices of War Assets Administration. They may be obtained, however, by contacting any of the War Assets Administration offices listed below. Equipment from 200 to 400 amperes in DC, gasoline-engine driven and AC sets are available in smaller quantities . . . also multiple operator types and related equipment such as electrodes, welding rods, weld positioners and flame cutters. Spot, seam and flash welders are likewise available. The equipment is for both production and construction. Write, wire or phone your War Assets Administration office today.

ALL ITEMS SUBJECT TO PRIOR SALE



HOBART
Standard models of this make available in large quantities and most ratings.

WESTINGHOUSE
Portable models available in limited quantities.

RESISTANCE WELDERS
Spot, seam, butt and flash type welders for production operations—also portable or gun types.

WELD POSITIONERS
Many sizes and capacities, including head and tailstock combinations.

FLAME CUTTERS
Both single and multiple torch types, portable and stationary.

FREE FACTS

TO WAR ASSETS ADMINISTRATION:
Please send me information on availability, condition and location of the following types of equipment:

- ☐ HOBART ARC WELDERS
- ☐ LINCOLN ARC WELDERS
- ☐ WESTINGHOUSE ARC WELDERS
- ☐ .....ARC WELDERS
- ☐ ..... (other equipment)
- ☐ RESISTANCE WELDERS (spot) (seam) (flash)
- ☐ FLAME CUTTERS
- ☐ WELD POSITIONERS (capacity).....
- ☐ WELDING ROD OR ELECTRODES

Name.....

Firm.....

Address.....

City.....*State*.....

176-1

VETERANS OF WORLD WAR II

To help you in purchasing surplus property, veterans' units have been established in each War Assets Administration Regional Office.

WAR ASSETS ADMINISTRATION

OFFICES LISTED BELOW ARE TEMPORARILY IN RECONSTRUCTION FINANCE CORPORATION AGENCIES

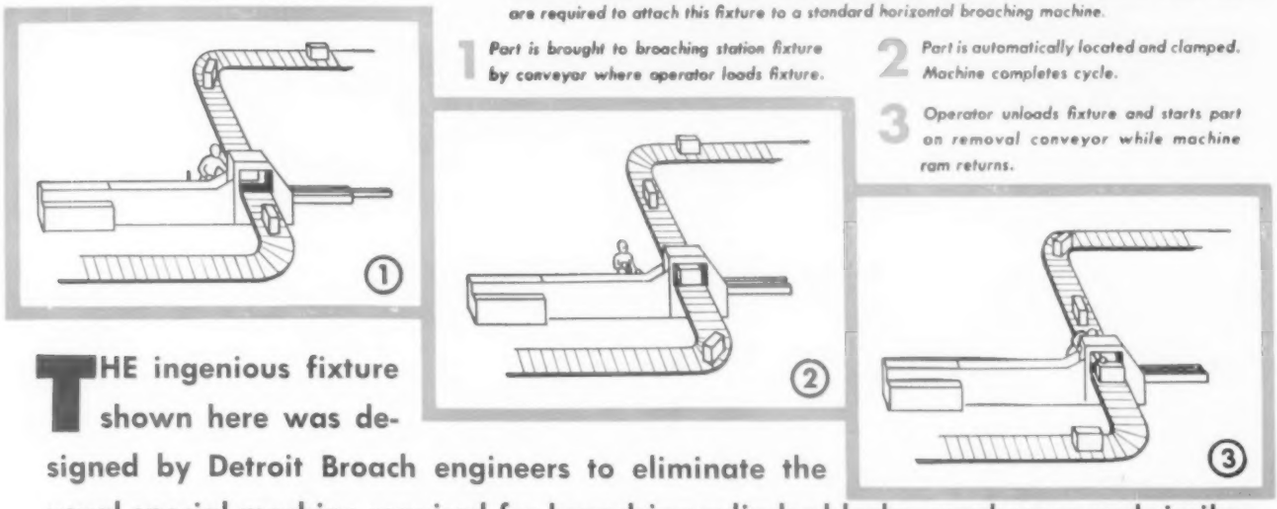
Offices located at: Atlanta · Birmingham · Boston · Charlotte · Chicago · Cleveland · Dallas · Denver Detroit · Helena · Houston · Jacksonville · Kansas City, Mo. · Little Rock · Los Angeles · Louisville Minneapolis · Nashville · New Orleans · New York · Oklahoma City · Omaha · Philadelphia Portland, Ore. · Richmond · St. Louis · Salt Lake City · San Antonio · San Francisco · Seattle · Spokane Cincinnati · Fort Worth (Telephone 3-5381)

176-1

Broaching CRANKCASES and CYLINDER BLOCKS

ON A *Standard Machine*

Above is shown the fixture; note the standard face plate. No special arrangements of any kind are required to attach this fixture to a standard horizontal broaching machine.



1 *Part is brought to broaching station fixture by conveyor where operator loads fixture.*

2 *Part is automatically located and clamped. Machine completes cycle.*

3 *Operator unloads fixture and starts part on removal conveyor while machine ram returns.*

THE ingenious fixture shown here was designed by Detroit Broach engineers to eliminate the usual special machine required for broaching cylinder blocks, crankcases and similar very large pieces. The fixture is attached to the end of a standard horizontal broaching machine. Production is very high and loading and unloading are very simple.

This is another instance where wide experience in broaching and imaginative application of proved engineering principles by Detroit Broach engineers has produced a tooling that facilitates high production at low cost.

Talk over your production plans with a Detroit Broach man. There may be many places in which he can suggest changes that will reduce costs, often using existing equipment.

MEMBER BROACHING TOOL INSTITUTE

DETROIT *Broach* COMPANY

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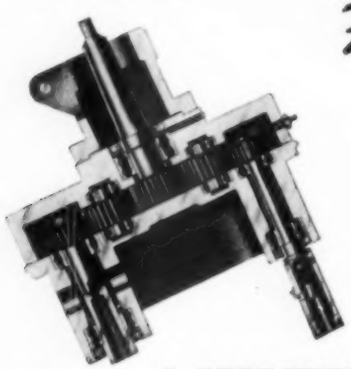
THRIFTMASTER

Full Ball Bearing Construction

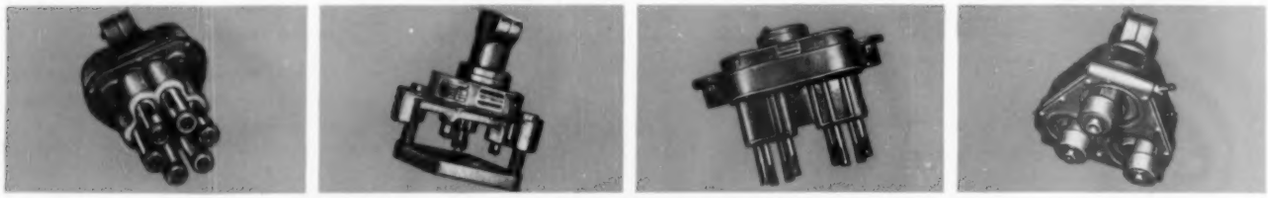
for Longer Life
Higher Production
Higher Profits



Thriftmaster Drillheads are *job engineered!* For recommendations and quotation (without obligation) write our engineering department.

Descriptive catalog on request.

MULTIPLE SPINDLE DRILLHEADS



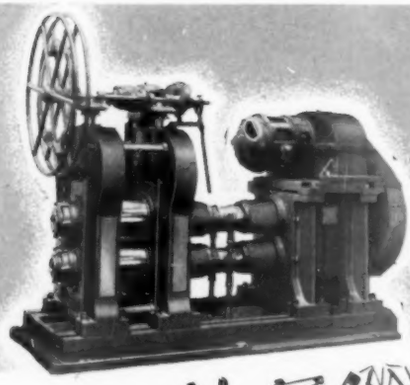
Detroit Representative: B. E. Parish, 3340 Fenkell Avenue

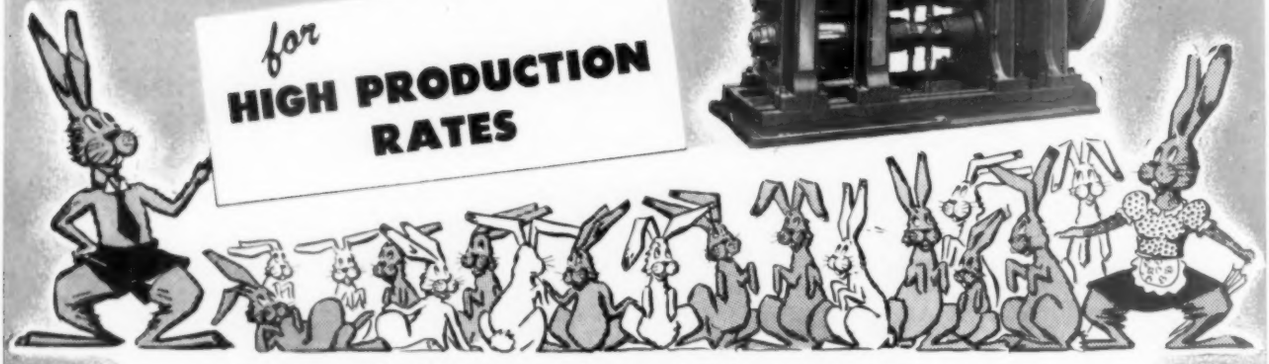
THRIFTMASTER PRODUCTS DIVISION *THOMSON INDUSTRIES, INC.*
29-05 Review Avenue, Long Island City 1, New York

"Standard"

ROLLING MILLS

for **HIGH PRODUCTION RATES**





"Standard" Rolling Mills assure high production hot or cold rolling of your strip, rod or ingot. Speeds are provided for rolling metals in any range from 10 feet to 500 feet per minute, depending upon your needs. Two, Three, or Four High Mills are available with roll sizes from 1½" diameter and 1" face to 16½" diameter and 18" face.

"Standard" manufactures special units for grading, cross and pinch rolling, forming wire to exact dimensions, and for a large variety of shaping operations.

CATALOG SECTION RM AND DETAILED RECOMMENDATIONS WILL BE SENT UPON REQUEST.

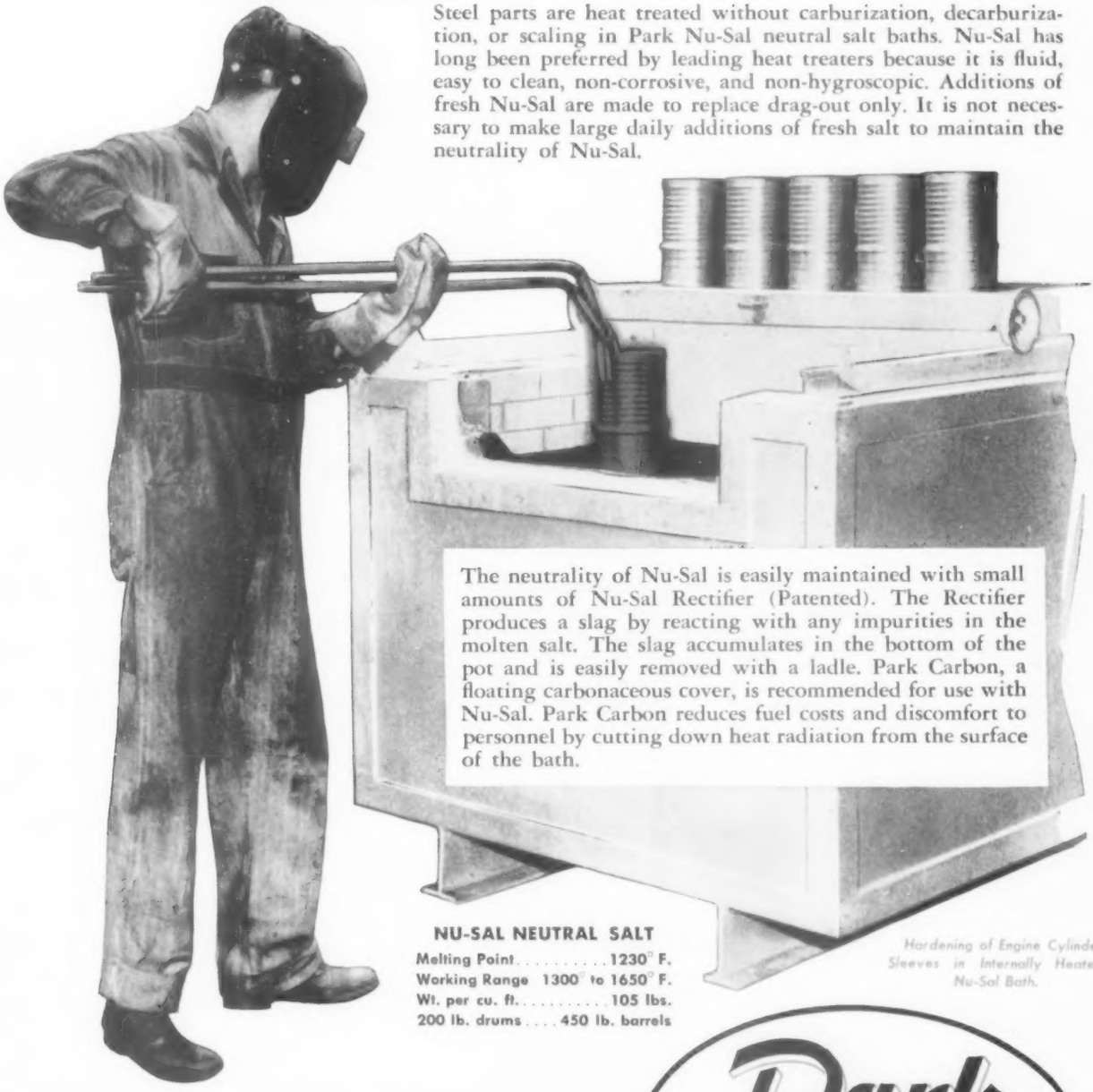
STANDARD MACHINERY COMPANY
1585 ELMWOOD AVE., PROVIDENCE 7, R. I.

Absolute Neutrality

TO STEEL SURFACES

with Nu-Sal Neutral Salt Bath

Steel parts are heat treated without carburization, decarburization, or scaling in Park Nu-Sal neutral salt baths. Nu-Sal has long been preferred by leading heat treaters because it is fluid, easy to clean, non-corrosive, and non-hygroscopic. Additions of fresh Nu-Sal are made to replace drag-out only. It is not necessary to make large daily additions of fresh salt to maintain the neutrality of Nu-Sal.



The neutrality of Nu-Sal is easily maintained with small amounts of Nu-Sal Rectifier (Patented). The Rectifier produces a slag by reacting with any impurities in the molten salt. The slag accumulates in the bottom of the pot and is easily removed with a ladle. Park Carbon, a floating carbonaceous cover, is recommended for use with Nu-Sal. Park Carbon reduces fuel costs and discomfort to personnel by cutting down heat radiation from the surface of the bath.

Hardening of Engine Cylinder Sleeves in Internally Heated Nu-Sal Bath.

NU-SAL NEUTRAL SALT

Melting Point . . . . . 1230° F.
Working Range 1300° to 1650° F.
Wt. per cu. ft. . . . . 105 lbs.
200 lb. drums . . . . 450 lb. barrels

● Liquid and Solid Carburizers ● Cyanide, Neutral, and High Speed Steel Salts ● Coke ● Lead Pot Carbon ● Charcoal ● No Carb ● Carbon Preventer ● Quenching and Tempering Oils ● Drawing Salts ● Metal Cleaners ● Kold-Grip Polishing Wheel Cement.

LICENSED MANUFACTURER: Electric Resistance Furnace Co., Ltd., Weybridge Surrey, England

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CHEMICAL COMPANY
8074 Military Ave., Detroit 4, Mich.

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MEANS DOUBLE SAVINGS

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BY HAVING YOUR WORN OR OBSOLETE TOOLS ADAPTED TO YOUR PRESENT NEEDS

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BY ELIMINATING LONG WAIT FOR NEW TOOLS

We Rework High Speed and Tungsten Carbide Tools

We Are Represented in Your City

National Tool Salvage Co.

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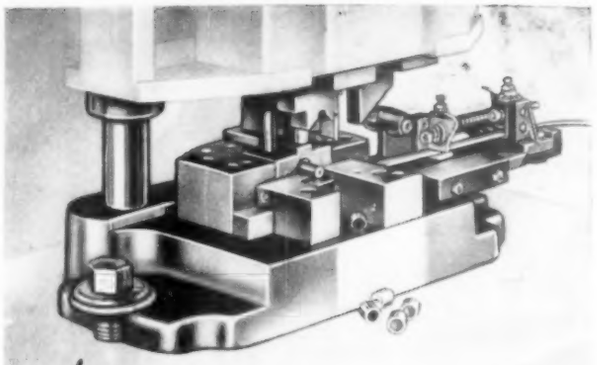

for

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With Dickerman Hitch Feeds for your punch presses, you'll get top production at rock-bottom cost. They are accurate, reliable and easily changed from one die to another. Send now for descriptive booklet.

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MANUFACTURED BY

H. E. DICKERMAN MFG. CO.

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ECLIPSE *Specializes*

IN DESIGNING AND BUILDING

END CUTTING TOOLS

THAT SOLVE DIFFICULT MACHINING PROBLEMS!

OUR CATALOG NO. 46

Completely covers the subject of special and "on-the-shelf," quick-interchangeable, fluted end cutting tools. 108 pages of data and illustrations show how production operations can be combined, out-put increased and costs materially reduced.

Eclipse' engineering service is available to you. Send us the print of your part—and be sure to order the catalog today—on your letterhead.

ECLIPSE COUNTERBORE CO.

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DETROIT 20, MICHIGAN

Our 3 POINT POLICY

Insures Lower Production Costs for YOU

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DIES · FIXTURES · JIGS · GAGES *are*

1. *Engineered for maximum production capacity*
2. *Built Right*
3. *Priced Right*

Our customers like this 3 Point Policy. It keeps production costs down—helps keep them "in line." ★ Every tool we design and build must measure up to this yardstick. If you need tools to get work out F-A-S-T and without interruption, drop us a line TODAY!

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Manufacturers of "Quality" Products

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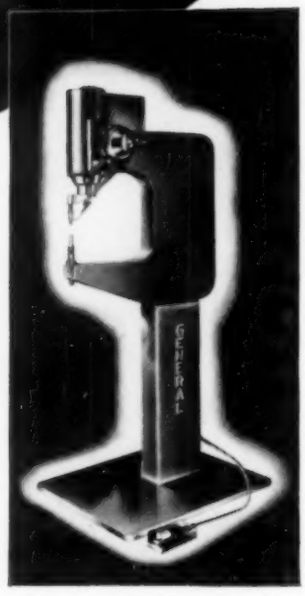
RIVETERS
Built for YOUR Job at "STOCK-LINE" prices



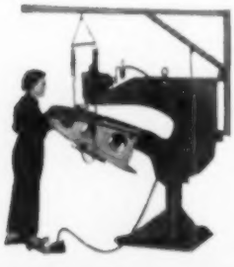
General Riveters will furnish a machine tailored to exactly fit your needs at a stock item price

THERE'S no need to pay a premium price for a special machine. If you have a riveting problem, we have the answer in a riveter especially designed for your job. Best of all, it will probably cost no more than a stock riveter.

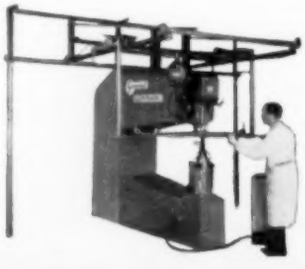
Under present conditions, many industries find it aids production, where the work permits, to use General Automatic feed riveters, equipped with indexing fixtures. They insure maximum output by setting the pace for the operators, and improve quality by reducing the human element.

Let us survey your riveting operations and recommend the best equipment for the job. There is no obligation. Simply send blue-prints or samples of parts to be riveted with a description of your present assembly procedure and production requirements. General Riveters Equipment is guaranteed, deliveries are prompt.

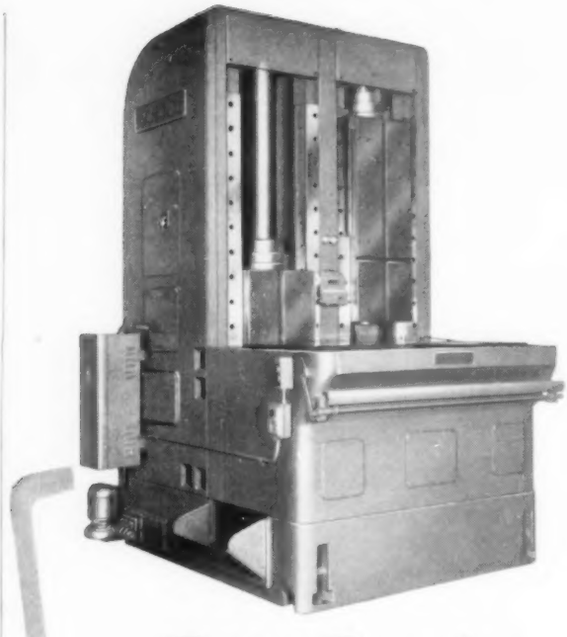
Pneumatic Squeezer for leading edges.



Combination Drill and Automatic Feed Hydraulic Squeezer.



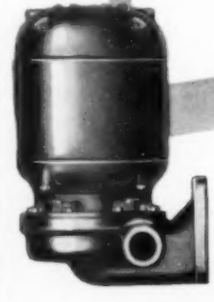
GENERAL RIVETERS INC.
formerly GENERAL ENGINEERING CO.
781 HERTEL AVE. BUFFALO 7, N.Y.



Better Broaching
When Modern Machines Team With
Pioneer Pumps

• Constant delivery of a heavily compounded fluid to the work point is essential for successful broaching. Pioneer Pumps—specified as standard equipment by leading machine tool manufacturers—are aiding many broaches to perform one of the most rigorous of all cutting operations.

Compactly streamlined, the Pioneer VBA enhances both the appearance and ability of machine tools. It functions efficiently in shallow places, beyond the range of most pumps, and is representative of the 400 standard models manufactured by Pioneer . . . each and every one of them an able ally for modern machines.



Model "VBA" Colonial Dual Ram Broach and Pioneer "VBA" Pump, shown above, form a combination ready to handle the toughest assignment.

PIONEER *Pumps*
SEAL TYPE, SEAL-LESS AND ROLLWAY
FOR PUMPING COOLANTS • CUTTING FLUIDS
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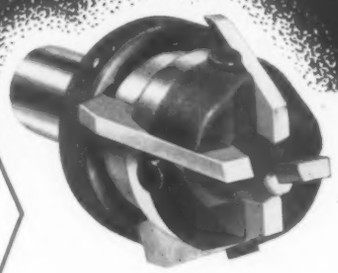
19645 JOHN R ST. • DETROIT 3, MICHIGAN

GENESEE

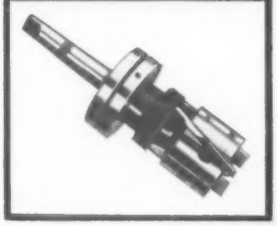
ADJUSTABLE HOLLOW MILLS WILL INCREASE YOUR PRODUCTION



STYLE M • Blades set at rake angle for cutting steel, aluminum, and other materials requiring rake.

INSERTED BLADE FACING & COUNTERBORING TOOLS

SPECIAL HIGH PRODUCTION TOOLS



• THERE IS A GENESEE for every hollow milling job. Available in 16 styles. Standard sizes from 0 to 2", with straight or Morse taper shanks carried in stock . . .

- ➤ Each size tool has 1/8 range.
- ➤ Blades quickly ground in a simple fixture.
- ➤ All tools manufactured of heat-treated alloy steel.
- ➤ Adjusting threads are ground from the solid and adjusting rings are lapped for extreme accuracy.
- ➤ Available with high speed steel, cast-alloy, or Tungsten Carbide tipped blades.

Genesee Tools will increase your production—35 years of know-how is yours for the asking . . . Write for complete catalog No. 45.

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GENESEE
EST. 1908
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ADJUSTABLE HOLLOW MILLS • FACING AND COUNTERBORING TOOLS • SPECIAL PRODUCTION TOOLS

INDUSTRY'S NEW SET OF TOOLS

Gage Blocks with Instruments

Band Files

Band Saws

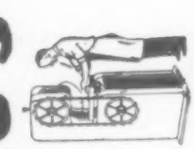
SPEEDMASTER

Dust Collector

Colloidal Oils

Magnetic Chucks and Selectron

Surface Grinders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Minnesota

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Young Roller Clutch Precision Mandrels

No more "C" washers, wrenches, drawbars, no more arcs or tapers before or after expansion grip—concentricity in low 10,000ths — production or inspection.

Assured parallelism of sleeve surface to center line—absolutely no variation in repeated mounting of parts. Uniform full-work-length friction-locking gives complete control and contact of entire bore surface area —Absolutely no variation in repeated mounting of parts—no tapers—Slip part on mandrel with slight counter-clockwise motion, that's all—it's ready—Self-contained, self-expansion, self-locking, self-contraction. Instant unloading, no jamming, no adjusting —Interchangeable sleeves—you do not obsolete Young Mandrels.—Built to your bore tolerance high limit, with automatic contraction to low limit—Any mounting—Any machine operation—For bore diameters .718 to 5.5—Reduces tool costs, extra equipment investment, operating costs, maintenance, down time, scrap, salvage.

Patent Pending

Quotations Definitely Moderate

Good delivery Schedules

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(ON THE TIP OF THE TONGUE)

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IN THE ART OF MILLING
WITH CARBIDES

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LOWELL & GRAYSON MFG. CO.

P. O. BOX 88
MONROVIA, CALIF.

P. O. BOX 1116
DETROIT 31, MICH.

In drilling flange hole of this exhaust manifold a special base was provided on account of its height. However, a Swartz L type fixture is plainly recognized.

Reduce Clamping Time of Odd Shape Parts

Rapid Clamping Can Be Applied to Any Part

One Wrench Often Replaces Four Slow Operating Clamps

Ask for Catalog 941

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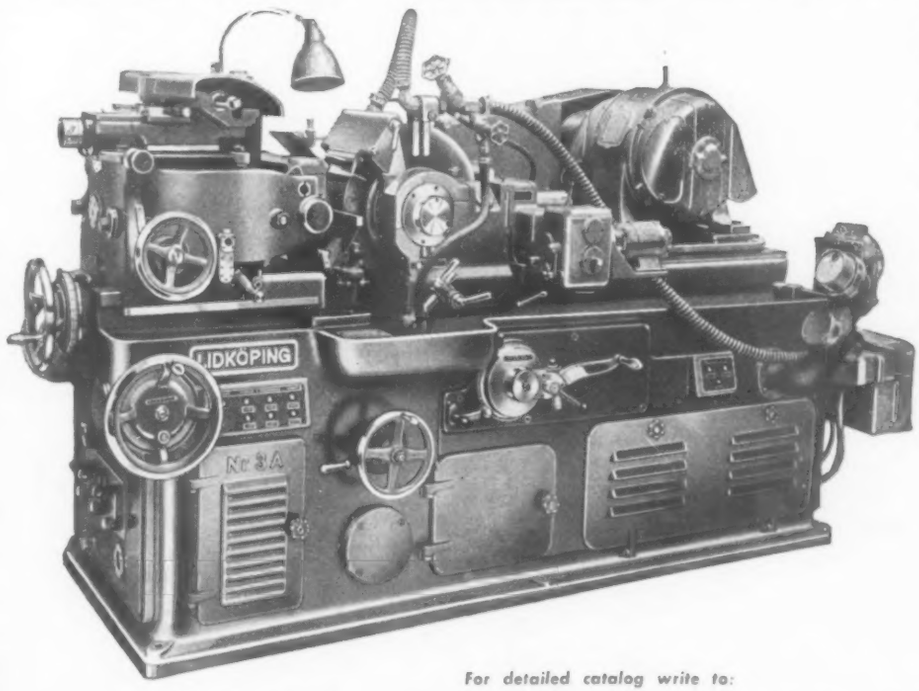

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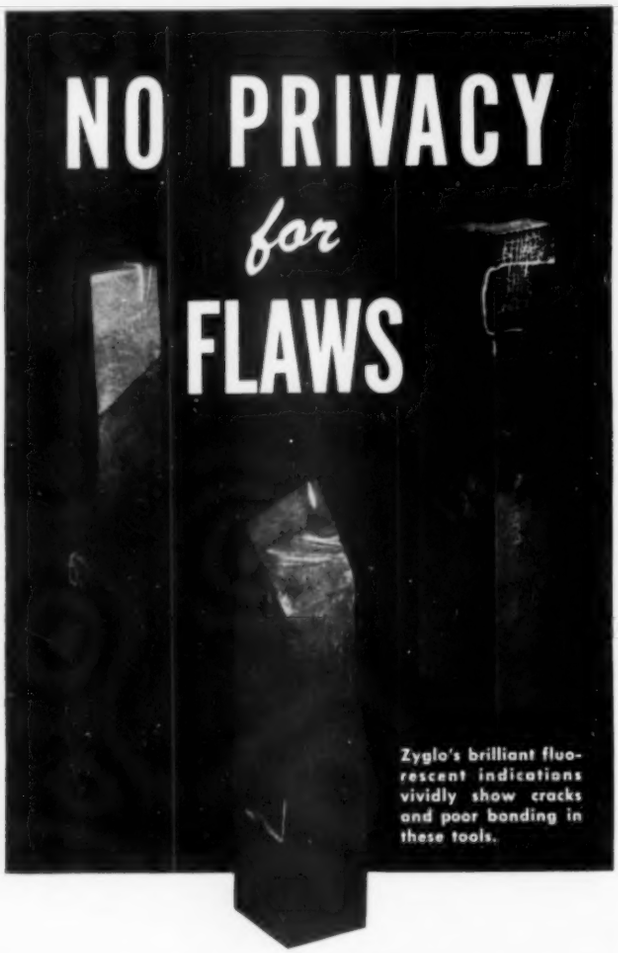

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- *CUTS STEEL NO ORDINARY FILE CAN TOUCH*
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- *OUTLASTS MILL CUT FILES 50 TO 200 TIMES*

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Kennametal blanks are attached by Phillips head screws. Two types are available: fine (30 teeth per inch); and coarse (20 teeth per inch).

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Weighs less than one pound. Can be handled with ease, and used for long periods of time with minimum expenditure of energy

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Handle is comfortable—it fits the hand; provides secure grip. Opposite end of file provides convenient finger hold.

KENNAMETAL
SUPERIOR CEMENTED CARBIDES
KENNAMETAL Inc. LATROBE PA

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COMPLETE FILE		FILE BLANK—2 REQUIRED		
CAT. No.	PRICE EACH	CAT No.	TEETH/ INCH	PRICE EACH
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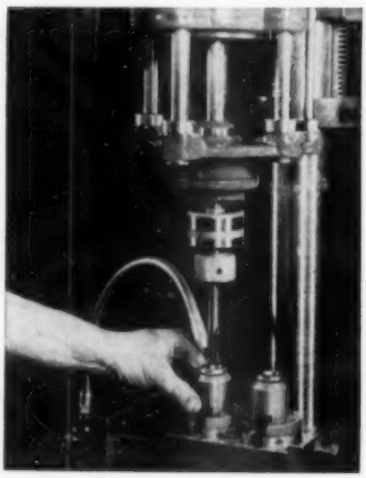

Ziegler Floating Tap Holder installed on "Detroit" LTM lead screw tapping machine

Want TO CURE SPINDLE MISALIGNMENT?

If tapping and reaming jobs are coming through constantly with oversize and bell-mouthed holes due to spindle misalignment, here's the cure!

Change over from ordinary tool holders to Ziegler Floating Tool Holders which are so designed that they automatically compensate for inaccuracies in spindle alignment amounting to as much as 1/32" radius, or 1/16" diameter.

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Ziegler Holders are furnished in types to fit any machine used for tapping or reaming.

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W. M. Ziegler Tool Co.
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Ziegler ROLLER DRIVE FLOATING HOLDER for Taps and Reamers...

ONE OK TOOL SET DOES MANY JOBS!

Get the most out of your LATHES, PLANERS SHAPERS, BORING MILLS

OK Tool Holders and Bits are available for all machine tools on the market, in sizes and shapes to handle all single point metal cutting. The Holders are made of alloy steel, heat treated for maximum strength and toughness—will give years of service. The bits, or cutting units, are of drop-forged, best selected High Speed Steel, heat treated for maximum performance. Cast alloy and carbide-tipped bits are also supplied.

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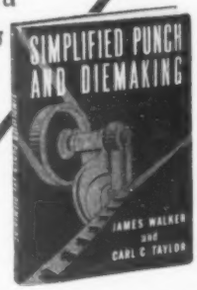

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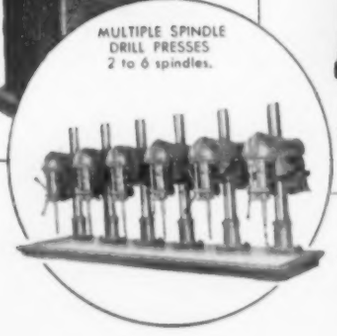

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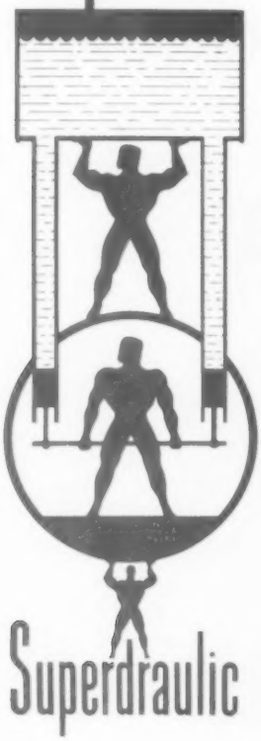

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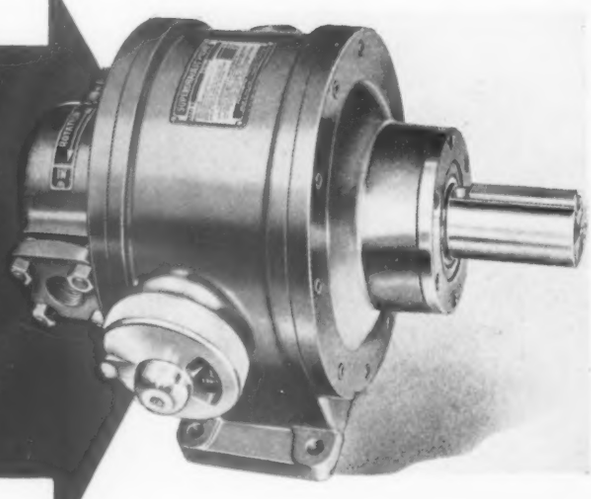

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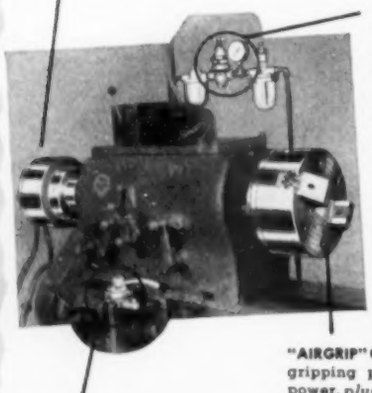

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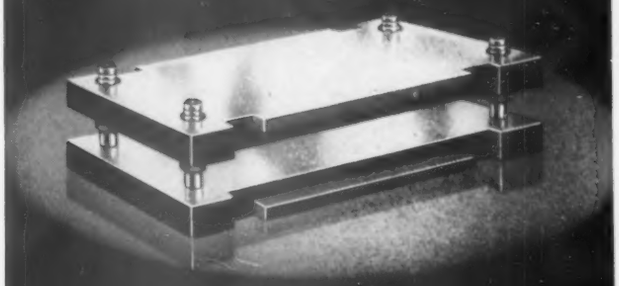

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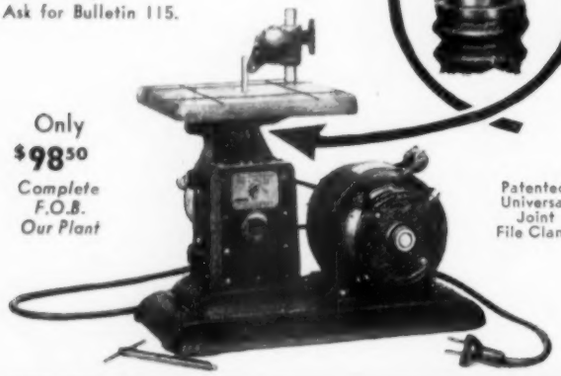

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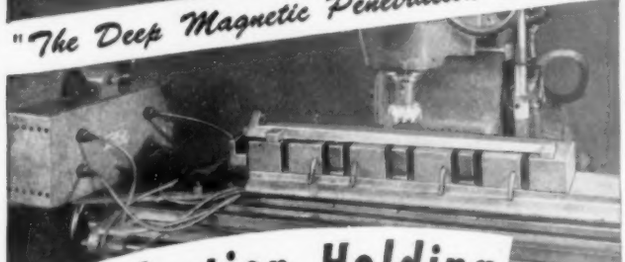

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Knotty Holding Jobs Simplified
Costly Time Lags Eliminated

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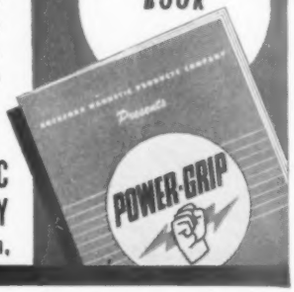

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Insert in bar.
Complete cutter bar and insert showing cutting edge.
The micrometer dial of the insert has 25 graduations, each being one-thousandths of an inch.

Write at once for complete descriptive bulletins.

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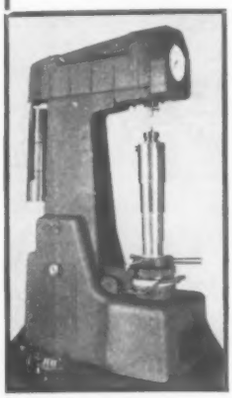

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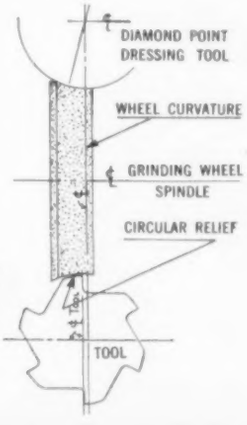

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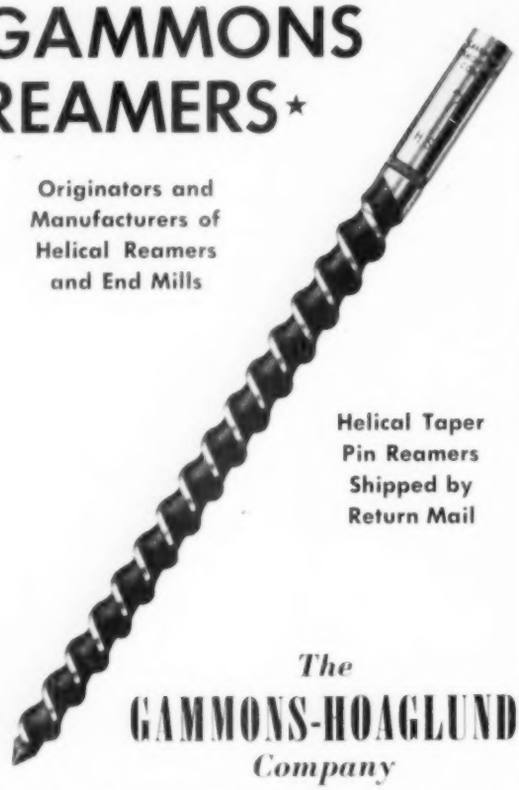

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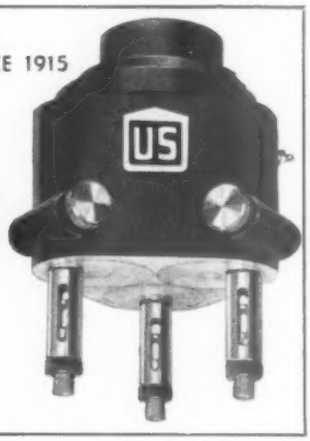

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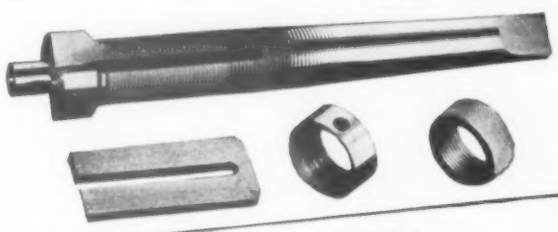

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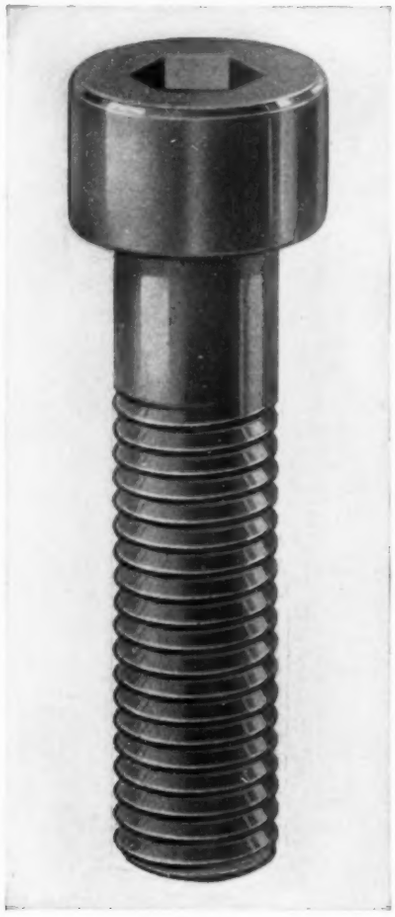

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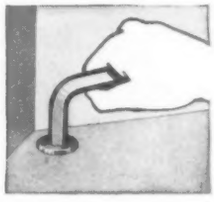

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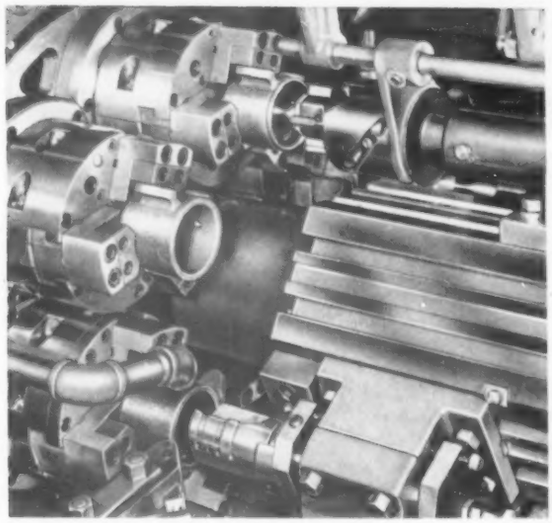
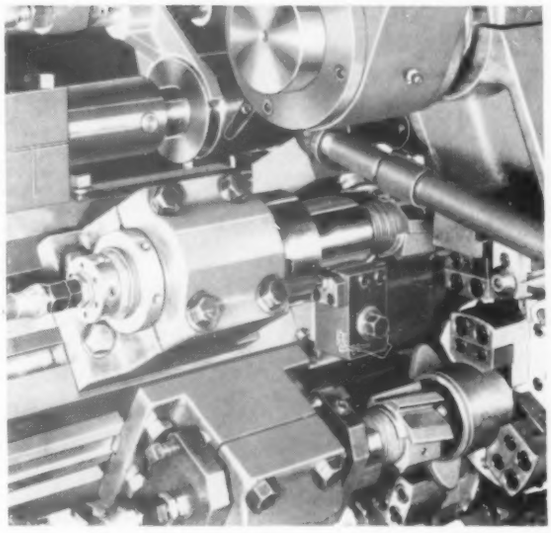
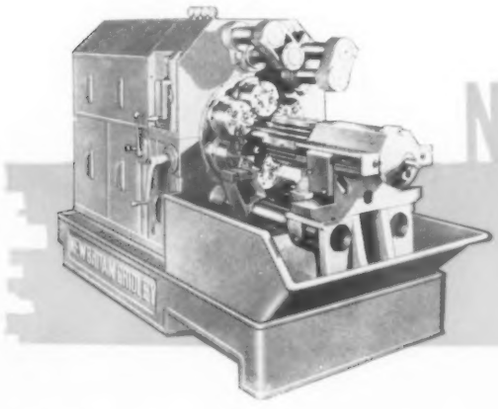
* Pronounced Hoo-dye



FRONT VIEW—Entirely open end construction provides accessibility for simplified chucking, cutting tool and attachment setup.



REAR VIEW—Wide open end construction provides extra large chip space . . . accessibility from three sides and from above that permits excellent visibility and easy tool adjustment.



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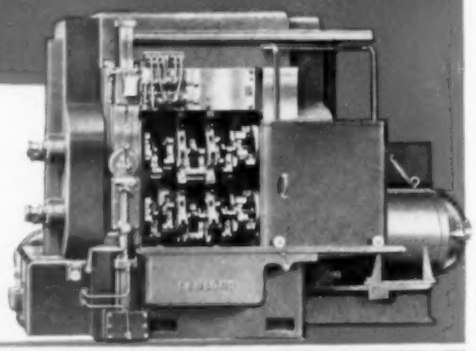
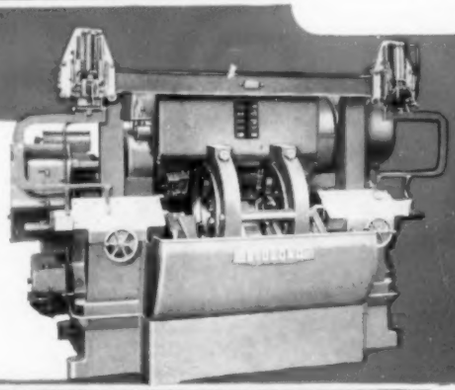
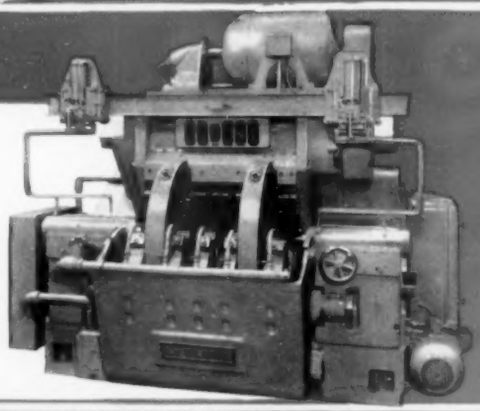
AUTOMATIC CRANKSHAFT LATHES



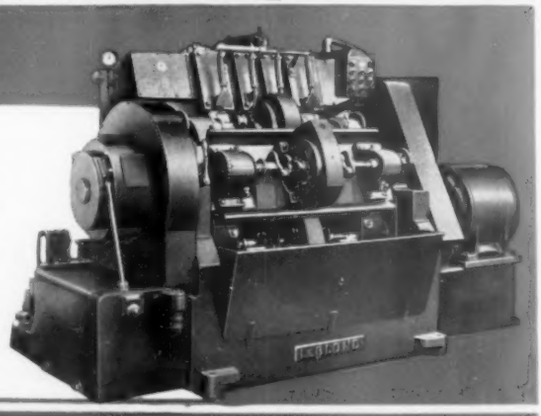
6AC 2 spindle, rough turns pin bearings on both spindles, or rough on one spindle, finish on the other.



7ACL Rough turns simultaneously on a single spindle all line bearings in one operation.



1LB Rough and finish turn line bearings at same chucking. Finish tools on separate cradle follow roughers immediately to reduce floor-to-floor time.



DM 4 Station index machine for finish turning all line bearings. Eliminates completely all rough grinding operations. Equipped with red and green control light system.

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